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EXPOSURES INDOORS

Giving clear and practical information about the hundred and one difficult problems surrounding indoor exposures—interiors or portraits—in homes, churches, factories, offices, and public buildings. The controlling factors explained; with tables and helpful diagrams.

The Photo Miniature

VOLUME XIV : JANUARY, 1917 : NUMBER 157

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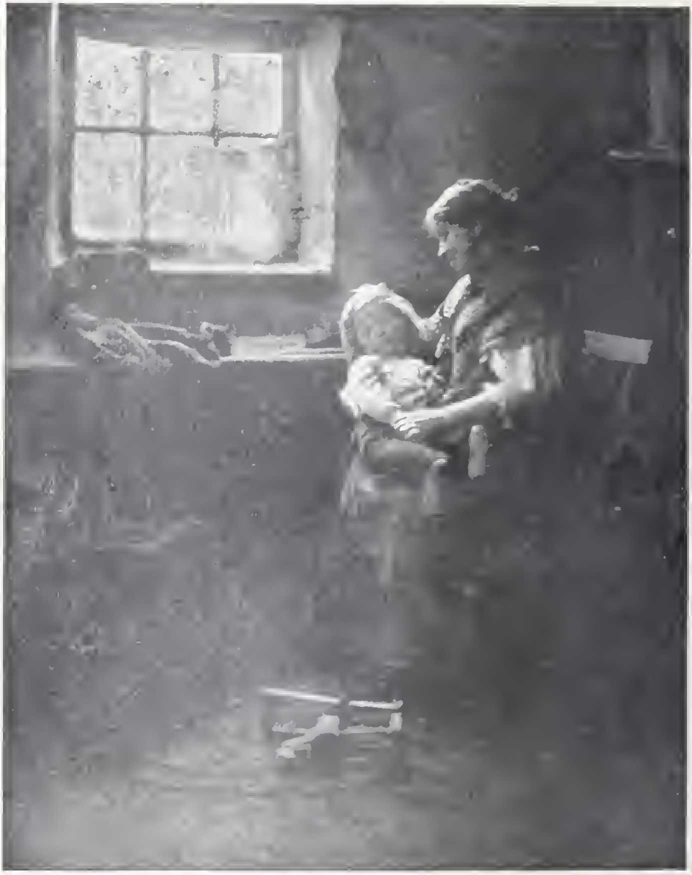
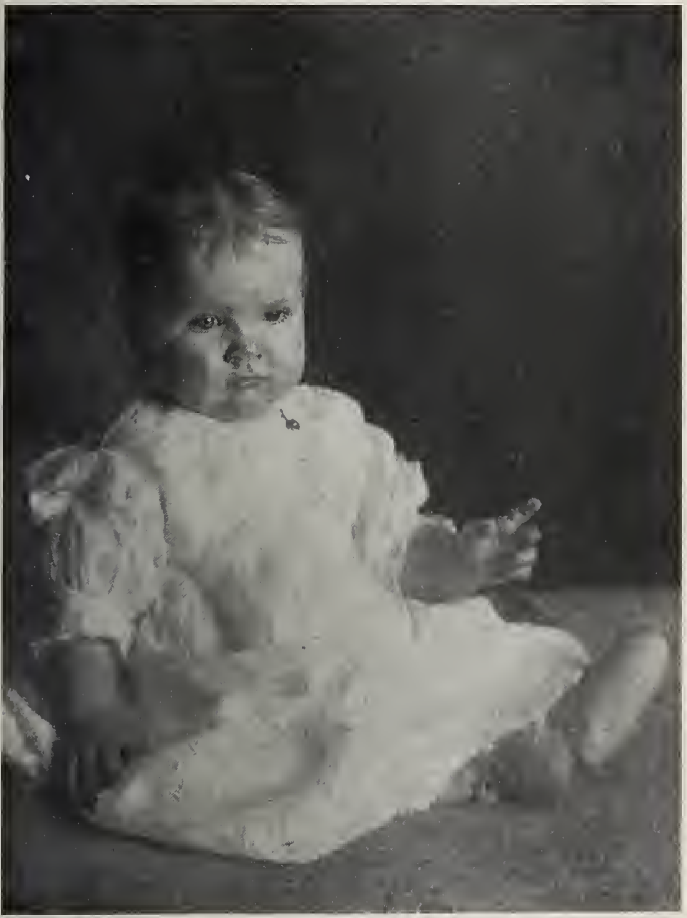
By Fedora E. D. Brown



The Orphan
By W. McLean
A clever example of the balancing of light and shade masses so as to concentrate the chief interest in the figure of the child and foster mother



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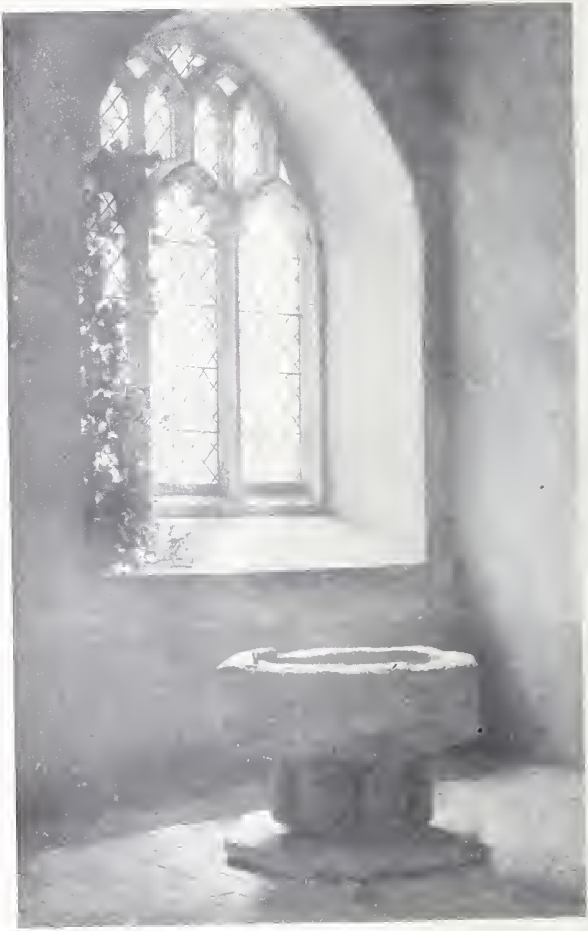
Pleasing pictures of children are easily obtained by seating them on the floor or upon a low stool near a window



A Saxon Font
By Walter Selfe
A good example of interior lighting and exposure made against the light

The Photo-Miniature

A Magazine of Photographic Information
EDITED BY JOHN A. TENNANT
Volume XIV JANUARY, 1917 Number 157

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Exposures Indoors

However complicated the problems of exposure may be that the photographer finds besetting his path out-of-doors, they assume insignificance in comparison with the number and complexity of similar problems within the four walls of a building. To considerations of time of year and of the day, of atmospheric conditions and lens aperture and speed of plate, he has now to add many others that defy the simple analysis to which these may be subjected. The size of windows and doors and their outlook and aspect as regards the sun, the crossing of lights, the finesse which direct sunlight pouring into an interior demands, the rapid decrease in light intensity away from its source, the different elements involved if the subject of the photograph is the interior itself or a person whose portrait is desired, the attention which the hangings and walls and even the clothes a sitter wears demand: here are questions enough for answer in every interior picture to give even the experienced man frequent pause.

Surprise need hardly be elicited, then, by the generality of imperfections resulting from interior photography or the frequency of out-and-out failure. The moment the photographer graduates across his threshold he encounters an altogether new situation in which the bugbears of under-exposure and lack of gradation, of excessive contrasts and halation, will be met at every turn. The present monograph is an effort to explain some of these difficulties, so that the photographer strange to interior work or troubled by its intricacies may not labor altogether in the dark. Its scope will not extend to the professional studio. Conditions there are more or less uniform; the work the light can do at any hour and under any sky is learned by innumerable experiences with it; the modifying factors of screens, reflectors and backgrounds are soon expertly calculated: the operations of the studio operator, in short, quickly become automatic. To the infinitely more varied conditions in ordinary dwellings, libraries, churches, halls, offices, factories, arbors, pergolas and porches the attention of the reader will be directed. Though the intention is to treat particularly of exposure problems, it will be impossible to avoid numerous references to lighting, so inextricably are the two interdependent; but they will be mentioned only with regard to alterations in the exposure which they entail, not with regard to their artistic features. These have been admirably handled in previous numbers of THE PHOTO-MINIATURE, to several of which reference is made in the following pages.

The Significance of Exposure

What it is we strive to achieve when we study questions of exposure is a matter for primary certainty. The perfect negative is one which will have gradations of tone from dark to light proportional to those of the subject from light to dark. Interlying tones respectively will be no nearer the darkest or the lightest in the negative than they were in the original. Such a negative is to be secured only by correct exposure. The saving virtue of all photography is that correct exposure is not an absolute duration in time, but a space within which any of several absolute durations may be correct. Every plate or film, in other words, permits some latitude. But outside the limits thereof incorrect exposure produces faults which cannot possibly be corrected in subsequent treatment of the negative. It has remained for comparatively recent investigation to establish this fact beyond question and finally to abolish the diluting and concentrating, the adding of bromide and the thousand and one other modifications of normal development which the photographer of an older time was wont so diligently to exploit. We are assured now that under-exposure will produce a plate which is, and which will continue to be, too light in the lighter tones and too dark in the darker tones; that exposure within the latitude of the plate will produce a negative with correct tonal variations, and that over-exposure cannot be prevented from giving us a flat negative in which little gradation in tone will appear from light to dark. The only function of development is to determine what the extremes of these gradations shall be; in other words, what the scale of tones, what the contrast. Now the best negative, while retaining the correct proportion between gradations, will have, for the sake of brevity in printing, the least density, but the latitude of many plates is not sufficient to permit the photographer to approach this perfection too closely. He must content himself with coming somewhere within the exposure latitude, trusting his experience to cut his time lower and lower for the plate he adopts. He will find this latitude less in fast plates than in slow, and, since fast plates are almost invariably indicated for interior work, less for subjects of that sort than is permissible when working out-of-doors.

Under-exposure: the Common Fault

If there is one apparent exception to this rule, that development modifications are futile, it is in the use of additional bromide for over-exposure. But even there the fact that a plate is over-exposed must be known before development starts if the bromide is to be of any effect and then its corrective ability is but slight. In interior photography we have to face the additional fact, when we are attempting to secure good printing density by a minimum of exposure, that whereas under-exposure in outdoor work entails grievous errors in the finished result, in interiors its results are almost hopeless. The great range in illumination indoors, except in such portraits as permit a modification of the lighting scale, demands correct exposure if full detail, verisimilar gradation and brilliance are to be achieved. It may almost be taken as a general rule, in fact, that we must make our exposures err toward too great length than too little, until experience with the handling of interior conditions has given us the facility for cutting it short and still keeping within the bounds of safety.

Avoid This Mistaken Notion There is one rather widespread impression among those who have not tried photography indoors to any successful extent that ought at the outset to be removed; that is, that sufficient light is not afforded in interiors for really serious work. The photographs that are shown in our publications and are hung throughout the year in our various salons ought to have dispelled that illusion long ago. It is constantly given renewed life, however, by the under-exposures which are the ordinary outcome of first attempts at indoor work. Nor is it the possession of some magic equipment that permits indoor photographs to be exposed correctly, for any lens that will take pictures anywhere will take them indoors if it is given time. There are doubtless merits possessed by fast lenses which render the task simpler for their possessors, but the rapid rectilinear and even the modest single meniscus lens are not incapable of thoroughly good work. That the understanding of what is offered herein may be simpler for the users of such lenses, the exposures cited have been uniformly reduced to the capabilities thereof, being always given for *f*/8 or U. S. 4, which is the normal largest opening of the rapid rectilinear lens. They are given, also, uniformly for a plate of the speed H. & D. 200, which is an extra-fast plate of about the rapidity of the "speed" film now offered generally to amateurs.

Different Light Conditions Though there are some few interior situations in which a shorter exposure is possible than in certain exterior ones—in the brightly lighted library, for instance, as compared with some shadowy woodland dell beneath the thickly overshot boughs of trees—as a general thing the alteration in lighting conditions and exposure when one crosses the door-sill is very real indeed. The sun's altitude is the same, the sky as brilliant as before, the windows and doors are, perhaps, quite large and broadly exposed to the exterior illumination, but the surprised tyro finds that he must give two or three seconds to his subject just within one of these windows whereas he gave but a fraction of one second just without. The developed negative which has been given too brief an exposure within doors will be the more surprising to him when he remembers that the light in which it was taken seemed to his eyes even brighter than the light at the same moment out-of-doors. He must learn, first of all, that the eye is not an unfailing guide, and for no fault of its own at that. Visual illumination and actinic light are apt to be two quite different media. The eyesight in the first place is largely governed by psychological processes; it adapts itself only partly unconsciously, almost as much by an exercise of the will, to interior conditions. The camera's lens and the substance of which sensitive plates are made are not so gifted. Even when the illumination within doors from the limited sources there present seems strong, it must be remembered that walls and ceiling have inhibited the reflected rays which form a considerable portion of the outdoor light. The highly actinic light from the blue sky, more powerful unit for unit at times than the glare of the sun itself, has been reduced to the very small portion which the windows admit. The refraction of the window-glass fails to pass a considerable portion of even the light which strikes its exterior surface.

Distribution of Light Indoors

Beyond the change in the quality and quantity of the light, another immense difference becomes immediately evident, and that is in its distribution. The intensity or actinic value of the light falls away with exceeding rapidity as the subject is removed from the light's source at the windows. To the farther corners of the rooms it progresses with the greatest feebleness. The shadow behind every piece of furniture that interrupts it is actinically of the deepest dark. Whereas, out-of-doors the source of the light is generally diffused to include the whole clear portion of the sky, indoors its sources are as numerous as the windows and doors and the beams from each of these cross each other at the most complicated angles. Contrasts, even beside windows with strong reflectors used to compensate for the one-sided illumination, are everywhere apparent, demanding in themselves modifications of the exposure. The necessity in many such cases of diffusing the light by various means introduces still further complication.

Compensations

Now let us take a long, deep breath, for that is all of the blackest side of the picture. The obverse is this: These modifying circumstances can all be analyzed and definitely understood. They can become with study and experience mere commonplaces for which but a moment's thought will suffice. Finally, they have been so analyzed and understood by thousands of photographers who have not yet graduated from the amateur class, but whose work merits the highest praise for its technical and artistic excellence. In this, as in every other photographic problem, experience is the most profitable teacher.

Getting Experience

Begin with your own home. Take pictures of its interiors from every possible angle. Impress your family into the task, utilizing them as your models for indoor portraits, and as many of your friends as you can. Exhaust all the possibilities of your own residence—and all the patience of the family, too, if that is necessary. In a moment we shall have to speak of the actinometer and its development, the exposure meter. The aid these will render you is beyond comparison. But even if you do not use them, you are not denied the simpler experiment of exposing a piece of printing-out paper in various exterior and interior situations and judging, by the length of time it takes in each to darken, the relative exposures demanded. It is an experiment that can be made at any time and it avoids the wastage of many and many a plate. When you have become quite familiar with the conditions in your own home, you may begin to try in other homes to which you have access, and then the verandas and pergolas and finally the libraries and the factories, the public buildings and the churches, being assured that you will find different questions to be answered in each, and that each will present continually more absorbing and delightful occupation for your skill.

The Actinometer

In its simplest development the actinometer is little more than the piece of printing-out paper which was just now suggested. The paper is contained within an opaque frame through which a small hole is cut and is pulled under this so that only a small portion is exposed at a time. The paper itself is also of a faster sort and modified chemically to a certain extent so that it darkens more rapidly in the light than ordinary printing-out paper, the action of which is rather too slow for the patience of the average person. If such an instrument is exposed to different lights, their comparative intensity can readily be measured by the speed with which the paper darkens. Actinometers have this additional value, that they measure the strength of the light actinically; that is, from the standpoint of the work it does on sensitive papers or plates. This actinic strength of light, as we have noted, is not necessarily the same as its visual intensity, for the same scale of the colors of which white light is made up does not act upon the eye as upon the sensitive plate. The actinometer, in fact, tells what we most want to know: what work a certain light will do upon a plate.

Exposure Meters

But, though the actinometer is of use in comparing one light with another, it still does not tell us exactly the exposure which we ought to give by either. To do this the actinometer has been developed into the exposure meter in which the time the paper used therein darkens under a certain light has been applied to plates of a standard speed, and a table prepared by which the exposure in any case is indicated directly opposite the time of the paper's darkening. In each of the various sorts of exposure meters is a piece of paper or color-disc of a standard tint. The time is noted which it takes the sensitive paper, also provided, to reach this tint in a certain situation. The meter translates that time into an exposure figure. Of such meters there are many sorts on the market, most of them procurable at very modest prices. The Watkins and Wynne meters are, perhaps, the best known, and both are made in several styles. Despite the rapidity with which the sensitive paper in all meters darkens in bright light, in the subdued illumination indoors the time occupied is so materially increased that it would be impracticable but for one thing. That is the inclusion in practically all the meters of a lighter tint to which the paper may darken in a time of a certain proportion to the standard tint. The Wynne meter has, for instance, a "quarter" tint, taking one-fourth as long to be approximated by the darkening paper as the "standard" tint. The Watkins meter has recently been offered in a new form containing a "one-sixteenth" tint. The newer forms of the Wynne meter are in watch-shape with the case opening like a "hunter" watch and disclosing the apparatus within. The Watkins meter is also made now with a stop-watch attachment, as is also the less widely used Adams meter. Grant's Chronoscope is of an arrangement slightly different from these, containing a lens which focuses the scene to be photographed upon the sensitive paper. It is exposed to the scene for a certain length of time and the resulting miniature picture matched as to tone with one of several standard tints provided. The result seems to differ only in picturesqueness from that of the other more common instruments. Steadman's Aabameter is the latest help of this sort. For those who accept the system of light measurement on which its use is based, it seems to promise real usefulness.

Where to Gauge the Light

Certain considerations in interior employment of the exposure meter are not to be overlooked by even the photographer who has been accustomed to its use out-of-doors. The meter should be placed at that portion of the scene where is found the darkest shadow *in which detail is desired.* This, be it noted, is not necessarily the very darkest shadow. Absolute truthfulness of detail throughout an interior need not always be secured at the expense of atmosphere and roundness. If one is seeking a map of every bit of graining in the most distant woodwork or of the pinheads in the cushion on the farthest bureau, then by all means he should set the exposure meter there, however dense the enveloping shadow may be. But it is rarely that such accuracy is desired. We carry in our minds a broader, more general impression of the scenes amid which we have our being, and it is a reflection of that ordinary content of our senses that we usually desire in the photograph. Set the meter, then, in a shadow of more nearly average density. The meter's face is generally to be toward the source of illumination, of course, as out-of-doors.

Time Economy

Because of the time consumed in using the exposure meter indoors, except with such meters as possess special lighter tints, this simpler plan for its employment has been suggested: stop the lens down to such a point as the meter in use indicates in its tables will give the requisite exposure in the time the paper takes to darken to the quarter tint. This, for instance, in the Watkins meter, will be about *f*/32 with a rapid (not extra-rapid) plate. Open the shutter at the moment the meter is put in place and close it when the quarter-tint is reached. If it is desired to use a smaller stop than the one indicated, the same procedure may be followed but the lens left uncapped for the necessary additional time— twice as long in the above example if the *f*/45 opening chances to be used instead of the *f*/32.

These indications of the practicability of the exposure meter and of the immense assistance which it may render are all that is necessary to tell about it here. Each exposure meter of any make is accompanied by full directions which will at once put the novice in perfect control of it. Why, in view of its simplicity, its low cost and its extreme helpfulness, the exposure meter is not in more general use, it is difficult to determine. In this country it seems even less to be employed than in England, but perhaps that is a reflex of the gambling spirit that differentiates the American from the Britisher in other things than photography. He hugely enjoys taking a chance.

Avery's Visual Method

With the exception of the more or less imperfect exposure tables which are mentioned toward the end of this monograph and those which I shall attempt to construct—which, by the way, may be open to as considerable a criticism—there is a rough-and-ready way of estimating indoor exposures by aid of the ground-glass to which the photographic world is indebted to J. H. Avery. He proceeded in this manner: with his head enveloped in the focusing-cloth he waited until his eyes had become quite accustomed to the image made with the largest stop. He then slowly reduced the aperture until the lightest shadows had just disappeared and only the brightest spots of light remained visible on the ground-glass. With this stop the exposure he found to be uniformly about 10 minutes, and he was enabled, by using the relationship between stops, to calculate it for the diaphragm opening he desired to employ. It must be remembered that, like the mere estimate of the eye mentioned above, this system is open to the objection that it measures the visual and not the actinic power of the light, but on occasions it may be found useful.

First Experiments

It is well for the novice at indoor work to become acquainted at the outset with the different lighting and exposure demands of straight interior photography and of interior portraiture. He will find that the light is more easily controlled over a small range than it is over a larger one; that he can direct it, modify it, reduce it, even increase it, within the few feet from a window in which he will attempt portraits, but that the task is less simple throughout the length of a 30-foot room. Because a portrait is taken so close to the window, some diffusion of the light therefrom, we shall learn later, is almost always necessary, and this diffusion will modify his exposure as the ground-glass in front of the arc light modifies the exposure in enlarging or the screen of bolting-cloth does the same. He is less put to it to diffuse for general interior views. Again, the scale of gradations in interior portraiture is ordinarily much shorter than in general interiors; shorter still than out-of-doors. In the portrait he will rarely have a higher light than a collar or cuff, materially reduced in brilliancy from absolute white by being out of the sun, or a darker dark than the shadows in a black dress materially lightened by a reflector. This will result, as compared with an outdoor picture, in a practicable increase of the latitude of the plate, and similarly as compared with an interior which contains a dazzling light at a sunlit window and a shadow beside yonder bookshelves which no light seems to reach at all. In short, remembering that the governing factor in all photographic exposure is the shadow, it will be found that the portrait close by a window puts less of a strain upon the photographer's skill than the picture of a general interior view with its extreme range of light and shade contrasts.

Lenses and Shutters

The question of equipment for indoor photography, so far as concerns its influence upon the exposure, need be but briefly mentioned. The superiority of an anastigmat lens, working at a large aperture and thus reducing an exposure that must be long under the best circumstances, is easily established. But when its superiority in indoor portraiture, where brevity of exposure permits less strained posing on the part of the sitter and less danger of inadvertent movement, has been noted, quite all of the story for our present purpose has been told. It makes no difference in the large majority of cases whether we take ten minutes to complete an exposure on an interior or twenty, and, hence, whether we employ an anastigmat working at *f*/5.6 or a rapid rectilinear at *f*/8. On the same plate the same density will be secured in each case. This has no connection with the correct rendering of lines, with the flatness of the field or with the clarity of detail and covering power by which we come to distinguish the anastigmat as of superior value, but solely with the matter of exposure. Similar considerations are involved in the choice to be made between a focal-plane shutter and one at the lens. Because of the larger amount of light it will admit during the same period of opening, the former undoubtedly will permit us shorter exposures than the latter. But again the practical application is rather to portraiture than to general interior subjects, to which we can ordinarily devote about as much time as we please. The portrait lens, so-called, which the professional photographer finds of supreme value in the studio, is barred to the ordinary amateur by its size, weight and cost, but its lack need occasion him no serious misgiving. In short, with whatever apparatus his purse and his inclination have provided him, he will find himself able to take interior pictures, even interior portraits, of unquestionable technical worth.

The Big Four

At the outset of the consideration separately of the factors which bear upon interior exposure now to be essayed, it is necessary for us to keep in mind that the total amount of light, the lens stop and the speed of the plate are the three factors chiefly involved, and that added to these is a fourth of great importance, viz., the relation existing between the shadows and the highlights. It is the shadows, complete or modified, which will largely govern our exposure. It is evident, therefore, that decreasing the density of the shadows, in other words, shortening the scale from light to dark, will permit us to shorten our exposures; that, finally, we shall need to know as much about the handling of the light as about the exposure which it demands. In general, we shall succeed with most subjects better if we keep in mind these two facts: first, that with a high, light key, the shadows softened by reflected illumination, the extreme highlights moderated by diffusion, a shorter exposure will always be needed; second, that our aim need not always be the securing of extreme detail throughout a print but the achievement of some measure of breadth and of that idealistic quality which artists generally know by the name of "atmosphere."

An Old Rule Illustrated

Indoors we are able more aptly to speak of the "sources of light" than outdoors. In the latter instance, the sources more or less coalesce into two, the sun and the sunlit sky. Indoors they are numerous and include the windows, the doors, the skylights if there be any, and the various contrivances we use for reflection. From each of these sources the light proceeds toward our subject and it proceeds in a peculiar way. We could discover with our exposure meter that four times as far from the source it is not one half so brilliant as twice as far but one quarter as brilliant; that at three and two times a certain distance from the window the relationship is not as two to three but as four to nine. The accompanying figure may help to make this plainer. (Figure 1.) If we can consider the window shown in the wall of the left-hand room as the source of light we find it will illuminate a space on the farther wall as indicated. If this part of the wall is removed to the exact limits of the space illuminated and all of the rays permitted to travel on just as far as before to the wall of the second room, they will be spread over a space four times as great as in the first instance. Their intensity over each quarter of this must, therefore, be but one fourth of that on the first wall. This rule may be accurately stated thus: "The intensity of the illumination coming from a given point and impinging upon a

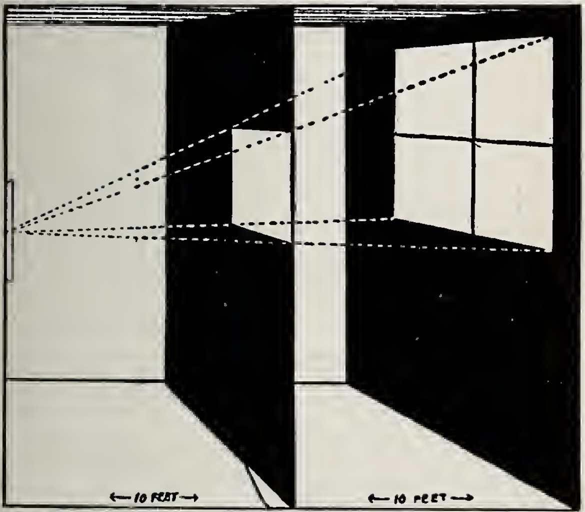


Fig. 1. Diagram to illustrate spreading of light and consequent loss of intensity as distance from source increases.

given surface is inversely as the square of the distance of this surface from the source of light."

Applied in Practice

We are enabled thus to understand why it is that the light penetrates so feebly into interiors, however bright it may be at its source at the windows; why the distant parts of our interior pictures, with insufficient exposure, are masses of shadow without distinguishable detail; why a small light source close to a sitter is as powerful as a large one farther away (see Fig. 2); why, in brief, we are apt, without knowledge of this fact, so certainly to under-expose. In the hypothetical case of a room 20 feet long, lighted only from one end we may compute the light at the farthest end to be of but 1-400th the brilliance which it possesses at the window. That is an extreme case. Fortunately the great majority of rooms are not so poorly lighted. Their distant corners are reached by light not only from the one window but from numerous opposite and flanking windows. Further modification is made by the fact

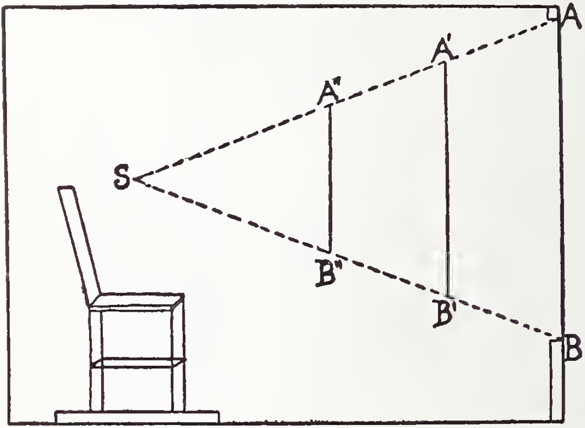


FIG. 2. The amount of light reaching the subject, S, will be the same whether it comes from window A-B, A'-B' or A"-B". A small illuminating source, therefore, will be as effective in reducing the exposure as a large one, provided only the subject is placed closer to it.

that the window is not a single point of light but a large number of such points, the number depending upon the size of the window. Windows in general will average somewhere about 25 square feet in extent. A larger window than this would give us additional light throughout its range; a smaller one would reduce our illumination. As the angle which the exterior light makes with the window is generally considerably elevated from the horizontal, it may be deduced that the interior space nearer the window is lighted chiefly by the lower portion thereof, and that its upper portion throws light into the more distant corners of the room. The darkness of ceilings is similarly explained; no window being high enough to illuminate them directly. The amount of illumination in the distant corners will depend, then, upon the height of the windows and will increase as that height increases. Also, the more closely the light-rays striking the window from without approach the perpendicular, the more brilliantly will the illumination near the window be concentrated and the darker it will become in the distant corners. Much more depends upon the outlook of the window, for one in the wall of a city flat where it overlooks but a narrow air-shaft will have manifestly but the smallest fraction of the lighting power of the window in a rotunda facing out to the open sea. Windows that are shaded by trees, by vines and by neighboring houses will be of evidently decreased value in the interior illumination they afford.

Variation in Light Transmission

It is interesting to note the effect which the glass of which windows and door panels are composed has upon the amount of light transmitted. In this regard it has been found that clean, brightly polished glass will intercept from 7 to 10 per cent of the light, and other sorts in the following proportions: plain glass, dirty, 40 per cent up; ribbed glass, 15 to 30 per cent; opaline glass, 15 to 40 per cent; ground-glass, 30 to 60 per cent. Considerations of a still more freakish nature are involved in interiors which are lighted wholly or in part by windows of stained glass, such as will be found in churches. Most readers are informed that white light is made up of a combination of red, orange, yellow, green, blue and violet; that the ordinary plate is most sensitive to the last two of these colors; that even orthochromatic plates, which are specially prepared by means of certain dyes to render them more sensitive to the other rays, do not altogether approach perfection in that regard; that the red rays and much of the orange and a portion of the yellow, even with orthochromatism, fail to impress themselves as easily or quickly upon the sensitive plate as the rays from the violet end of the spectrum. If the preponderance of light passed by these stained-glass windows is, then, of a reddish or orange tinge our exposure must be very materially lengthened like an exterior exposure near sunset when the sky is red; and, if it is of a green, blue and violet tinge, materially shortened. Incidentally, this is the distinction we draw when we speak of the visual and of the actinic power of different lights. A light is more actinic as it approaches in color the violet end of the spectrum, though its visual intensity seems to have materially decreased. (Fig. 3.)

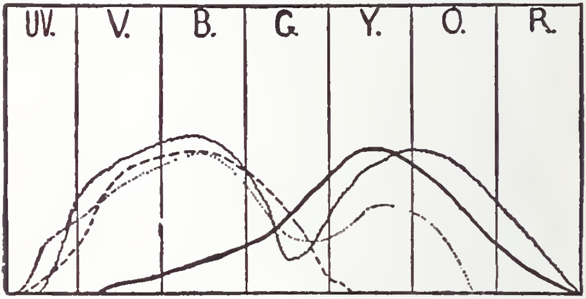


FIG. 3. How the vision and different sorts of plates are impressed by the spectral colors. The letters stand for ultra-violet, violet, blue, green, yellow, orange and red. Vision, represented by the solid line, is most sensitive to yellow; finds that the brightest color. Ordinary plates (broken line) are but little affected by yellow but are highly sensitive to violet and blue. Orthochromatic plates (dotted line) to a considerable extent combine these two. Panchromatic plates (wavy line) increase still further the sensitiveness of the red end of the spectrum. The diagram well illustrates how faulty the judgment of the eye is apt to be in estimating the actinic strength of light.

Different Aspects

The aspect of the window as regards the light is a subject upon which you will find much difference of opinion. It is admitted that the north window, being on the side of the house away from the path of the sun from morning to night, is more equably lighted throughout the day than that in the south wall. For this reason, its illumination has been usually sought by the artist who cares more for the steadier light than for the brighter. In his footsteps photographers have been prone to follow, and the great majority of professional studios for this reason are built with a north-light aspect where uniform lighting conditions, and hence uniform exposure, are more simply achieved. But the variety of effects which south windows offer, even by their admission of direct sunlight if this is used for unusual effects with caution and understanding, are not to be despised by the indoor photographer who scorns the beaten path and seeks some measure of individuality in his product. With the one window that is ordinarily all that is needed for indoor portraiture, it will be found in most cases that the conventional example may be more slavishly followed with uniformly good results. If the north lighting is not easily to be secured, an east window in the afternoon or a west window in the morning will serve the same purpose, except here it must be noticed that the late afternoon light in the former case and the early morning light in the latter will be considerably reduced from what could be had at the north. In regard to the south window it must also be said that the intensity of the illumination there increases the depth of the shadows, and hence the exposure, unless by skilful use of reflectors we modify the contrast. The lighting is, as a rule, most easily handled when the sun from without just touches the window. At those windows away from the light, finally, care must be taken if the light thrown is flat that the exposure be not too extended, or the impression of flatness will be further exaggerated. Exposures at west and south windows will usually call for reflectors to equalize the shadow lighting, and thus award too much contrast.

Windows

If it is no more than to raise the shades to the top, most windows need some sort of treatment to adapt them to the photographer's purpose, the chief portion of which is, technically, to assure himself the possibility of approximately correct exposure. It is sometimes necessary, if more light and shorter exposure are demanded, to remove shades and curtains altogether from the windows. Especially will this often be necessary when the range of tones is extended by distant dark corners of the room, and uniformity of exposure hence impossible. Particular care has to be given to the treatment of windows in front of the camera. So long as these are not directly in the field of vision, the difficulty is simpler of solution. The only danger then lies in their throwing so strong an illumination upon the lens as to render good gradation impossible and more or less fog highly probable. This difficulty is obviated by the use of a sky-shade or lens-shade over the lens. The former may be just a section of cardboard fastened to the lens board by a rubber band and turned until it is on the side of the lens from which the objectionable glare comes. Caution must be exercised that the card, which ought to be black, does not cut into the field of vision and, if it is not matte in surface, does not reflect light from the other side against the glass. Lens-hoods, which are simply an extension of this card circularly all about the lens, are purchasable at reasonable rates or may be simply constructed of black dull-finished cardboard.

Halation in Interiors

When the window which is found objectionable is, however, directly in the field of view in making an interior view an added difficulty is presented—that of halation. Further attention will be paid to this difficulty in later pages under the subjects of halation and of taking exterior and interior views in one exposure through the window. For the present it will suffice to say that windows directly in the field of view must be covered either during the whole or part of the exposure with some opaque material or non-halation plates employed. It will often be found that a slight alteration in the position of the camera, while not modifying to any extent the view obtained, will throw such windows behind a partition, column or post and reduce their danger. Where drop shades are provided over the windows these may be tacked along their edge nearest the camera to the casement and their opposite side propped away from the window to such an extent that the opening, while not visible to the lens, will admit a considerable amount of illumination upon that part of the room beyond the window.

Window Portraiture

It is in the taking of indoor portraits that the modification of the windows calls for the best exercise of the photographer's skill in lighting and exposure. The intense glare which falls from a window upon the subject seated near it not only introduces a most unpleasantly harsh lighting but establishes so considerable a contrast that the short exposure requisite in portrait work is out of the question. How to subdue this contrast and lengthen the gradation range must be a prime consideration. For this purpose we use diffusing screens. In the photographer's studio one finds them mounted in circular wire frames supported by iron stands. In the home they may consist merely of tissue paper, white muslin or thin calico pinned over the window. If the upper part of the figure is too dark for uniform exposure, even with the shades raised to the top, the subject must be moved closer to the window, or the lower light reduced by opaque cloth over the lower part of the window and the exposure proportionately lengthened. The use of diffusing screens and of reflectors for lighting the shadow side of the figure will be considered more in detail in later pages.

Balancing Cross Lights

We have noted before that the light decreases (and the exposure, consequently, must be increased) very rapidly as the distance from its source is lengthened. In most interiors the situation is not so bad as this would seem to show because of the number of windows. In most instances about the spot where the illumination from one window has grown so dim as to force up the exposure beyond practicable limits, the light from another window comes into play and the lengthening exposure is modified by this new influence. Computation of the resultant of these competing light-sources with mathematical accuracy may be left to the physicist and his instruments. The photographer will ultimately find they may be judged by him with sufficient accuracy for his purposes. The point is to be certain to take them into account. Were this monograph given over to artistic considerations as well as technical ones, it would become necessary to point out the dangers of cross lighting and the subtlety with which it must be treated. This one warning may be offered without too far transgressing our limitations, that an artistic lighting, if it does not really do so, at least must seem to come from one direction; therefore that, with light falling upon the subject from two or more directions, it must be seen to that the intensity of one of these greatly dominates the others. There must be one main lighting and one only; the others must be subsidiary in degree if they are different in direction. The accom-

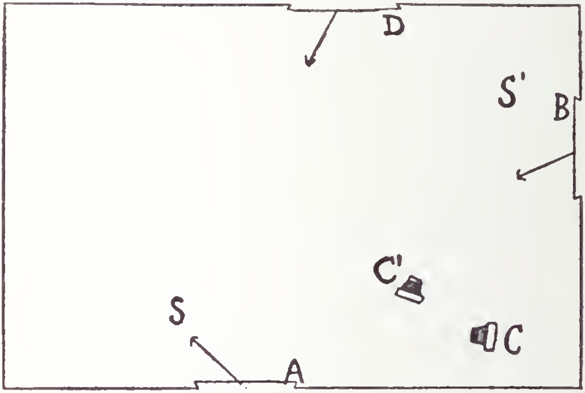


FIG. 4. Cross lighting is not always to be despised, especially in portraiture. With subject and camera at S and C, or S′ and C′, the former is lighted strongly by one window and the shadow on the further side is softened by the supplementary light from the other windows; thus, also, making a shorter exposure possible without the use of reflector.

panying sketch will serve to make all of this clearer. (Fig. 4.) If only the window A afforded light for this room, the exposure to secure detail by the farther wall would have to be of extreme length if the room were of any size. But the other windows, as in most rooms, greatly equalize the general illumination, even if they do not make it uniform, and the exposure consequently demanded will be much less than in the hypothetical instance. If we are essaying in this room a portrait we shall either depend upon the diffusing screen and reflector just mentioned or select such a spot, as at S, in the room with relation to the windows that our sitter's face will be rather strongly lighted from one side and the shadows thus created is softened by the illumination from one of the other windows. One difficulty in the latter arrangement will be to get the light high enough to do any good on the face. The problem of exposure and lighting where more than one window is utilized in portraiture will be simplified if we use but two windows, these preferable at right angles to each other and not too far apart, one of them larger and its light diffused (B), the other smaller and not diffused to lighten the shadows (D) with the subject at S^1.

Doorways as Light-Sources

Doorways as sources of light, because of their greater size than windows, are often a considerable assistance in the reduction of exposure. For standing figures they are even more serviceable because of the equable lighting over all the subject. Their height makes them additional aids toward lighting the distant corners of rooms which tax our exposure-time otherwise too heavily. One is inclined often to envy the professional photographer his skylight and the volume of light it throws into his studio, but a glance at the amount of paraphernalia he needs to adapt this light may make one question the genuineness of its help under all conditions. The amount of light cast by a skylight naturally increases toward noon and decreases away from it, and exposures decrease and increase inversely in the same proportion. But, except in cloudy or rainy weather, the glare is altogether too strong and considerable modification by diffusion cannot be dispensed with. The skylight introduces a new sort of shadows, vertical ones instead of horizontal if you please, but these are not less deadly in their influence toward extreme contrast than the others and must not less be taken into consideration in the exposure which should, generally, be quite full.

Controlling Factors in Lighting

The factors that govern exposure out-of-doors govern it as well within, modified by the other factors which we are considering. The general factors are, of course, the time of year and the hour of the day, because these express the angle of the solar illumination and hence its power; the brightness of the sky, the illuminative potency of which is reduced by haze and even more by clouds according to their density; the aperture at which the lens is used, the exposure increasing, according to the well-known rule, as the diaphragm opening is reduced, and the speed of the plate, which may vary through a ratio of one to eighteen or twenty.

Scott's Table

The variation in light-intensity has been expressed in different tables and formulæ for the use of photographers, the best known of the former being the tables prepared by Dr. A. J. Scott. These were drawn up by Scott for different latitudes. The table below is an adaptation from these to conditions along the 35th parallel of latitude, applicable to most of the United States without notable exception. It fixes the best light, that of noon in June at 1 as a standard and gives the comparative light-intensity in other months and at other hours in multiples thereof.

Table of Light-Intensities

A.M.	P.M.	June	May July	Apr. Aug.	March Sept.	Feb. Oct.	Jan. Nov.	Dec.
12		1	1	1	1	1	1¼	1¾
11	1	1	1	1	1	1¼	1½	2
10	2	1	1	1	1¼	1½	1¾	2¼
9	3	1¼	1¼	1¼	1½	1¾	2¼	3
8	4	1½	1½	1¾	2	2¼	4	7
7	5	2	2½	2¾	3¼	6	9	
6	6	4	6	9				

Readjustment

There has been some readjustment in recent years of figures expressing the variations in light-intensity due to the effect of clouds. The older tables which contained these data fixed the variation from the brightest sky to the dullest in which photography would be attempted at all at from 1 to 5. The investigations of Hurter & Driffield, exhaustive in this as in many other respects, reduced the variation to 1 to 4. In other words, if an exposure for a certain subject at a certain month and hour is one second under the brightest possible sky, under the densest clouds with which a photographer would attempt work at all it would be lengthened to four seconds. The intermediate steps are usually expressed as the condition in which a haze slightly obscures shadows and that in which clouds more or less inhibit shadows altogether. The first would necessitate twice as much exposure as a cloudless sky; the second, from two and a half to three and a half times as much.

Diaphragm Apertures

All of even the most elementary handbooks explain the subject of diaphragm openings as influencing the exposure, so that little time need be taken for that here. With the so-called "U. S." system of numbering stops the necessary computation is easily and accurately made if it is remembered that the exposure for one stop as compared with another is inversely in the same ratio as the number of the stops, e. g., U. S. 32 will demand twice as long as U. S. 16, one quarter as long as U. S. 128. With the "*f*" system the computation is only slightly less simple, each smaller stop taking twice the exposure of the stop next larger; thus *f*/16 will require twice the exposure of *f*/11 and one half that of *f*/22. The order of these stops (*f*/5.6, *f*/8, *f*/11, *f*/16, *f*/22, *f*/32, etc.) is easily memorized. Many of the manuals with which camera and lens manufacturers accompany their products contain the advice to the beginner that a smaller stop be used for interior work than that which is advised as best for snapshots out-of-doors. If the reason for this advice were given along with it—that the smaller stop allows of a wider latitude in exposure besides increasing the depth of field—it might be of more value. When one has become acquainted with interior exposure considerations, no reason but that of depth of field remains for the use of a small stop; in fact, many highly important reasons, such as reducing the length of exposure, exist for the employment of the largest stops available, especially indoor portraiture.

Plates and Films

Progress in the science of dry-plate production has made it possible for us now to secure rapid plates of practically as good quality in every way as slow ones. There remains little reason, therefore, for employing the latter for indoor work. Their only immediately apparent superiority lies in their being less apt to produce halation, and this fault may better be obviated by other means than that the exposure-time be unduly prolonged by their use. Moreover, the scale of indoor lighting is so broad that the use of slow plates is largely precluded. While they do give density in the well-lighted portions as satisfactorily as rapid plates, they are not so adaptable to the recording of detail in the deep shadows. According to their speed, plates are scaled in various ways, three of the best-known systems being those of Watkins, Wynne, and Hurter & Driffield. Manufacturers of plates, however, do not uniformly follow one or another of these systems in marking their product. As a rough guide to the speeds of various plates, excepting the ultra-rapid, the following table may be given:

COMPARATIVE PLATE-SPEEDS

Speed	Watkins Scale	Wynne	H. & D.	Comparative Exposures
Very rapid......	200	110	200	1
Rapid..........	180	90	120	1½
Medium........	100	64	70	3
Slow...........	50	45	34	6

Of the ultra-rapid plates, which are from 30 to 50 per cent faster than those of the first classification given above, these may be mentioned: Barnet's "550," Central Special XX and Special Home Portrait, Lumiere's Sigma, Marion's Record, Seed's Graflex and Wellington's Extreme.

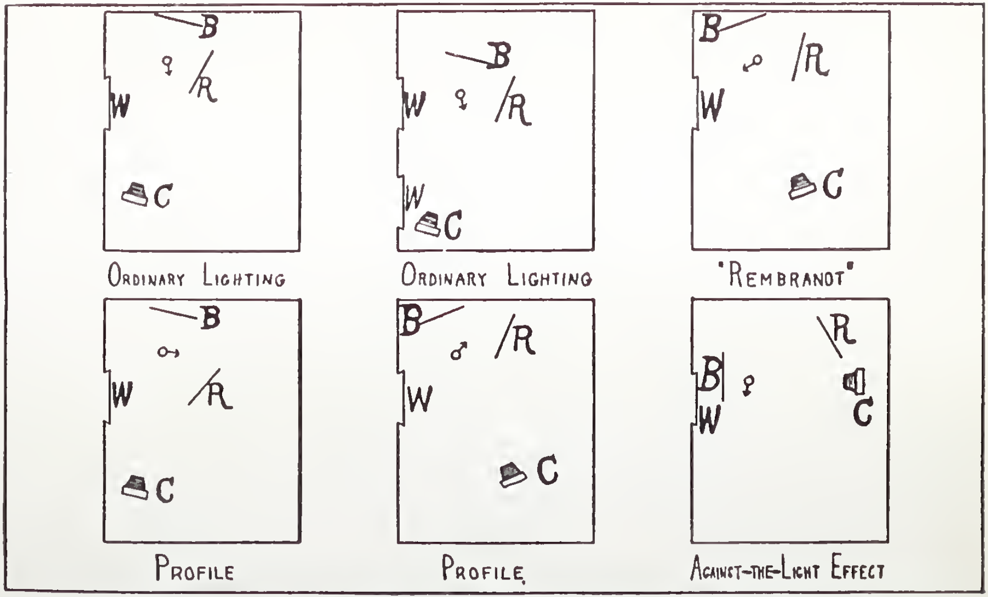
Among the plates and films in the "very rapid" class given above, the following are typical: Ansco, Speedex; Barnet, Superspeed Ortho, Red Seal; Central, Special; Cramer, Crown; Defender, Vulcan; Eastman, Portrait film, Speed film; Hammer, Special Extra Fast; Ilford, Monarch; Imperial, Flashlight, Special Sensitive, Orthochrome S. S.; Marion, Brilliant, P. S.; Paget, Swift, Extra Special Rapid; Premo, Speed pack; Roebuck, Blue Label; Seed, Gilt-Edge 30, Color Value; Wellington, 'Xtra Speedy.

Belonging to the "rapid" class are these: Ansco, film; Barnet film, Red Diamond; Burke & James, Rexo film; Central, Special Nonhalation, Comet; Cramer, Banner, Inst. Iso.; Defender, Vulcan film; Eastman, N. C. film, Hawkeye film; Ensign film, Forbes; Challenge, Snapshot; Hammer, Extra Fast, Ortho. Extra Fast, Aurora Extra Fast; Ilford, Zenith; Imperial, Rapid 225, Duonon; Lumiere, Blue Label film; Paget, Ortho, Ex. Spec. Rapid, Spec. Rapid; Premo, Filmpack; Gilt-Edge 27, Ortho.; Standard, Extra, Imperial Portrait, Orthonon, Polychrome, Thermić; Stanley, "50;" Wellington film, Iso. Speedy; Portrait Speedy, Antiscreen; Wratten & Wainwright, Panchromatic.

The medium and slow plates, scheduled above, will seldom be used for interior work.

Viewpoint in an Interior

Every interior permits more or less choice as to the portion to be taken, the situation of the camera and the arrangement of the lights and, consequently, the adjustment of the exposure. Artistic considerations will have much to do with the decision regarding the first three, but certain considerations of exposure require that we give them some further attention in this discussion. The view desired, its pictorial possibilities, will determine the position from which we first essay our picturing. There are several possible alternatives which are then open to us. If this situation is not only pictorially satisfactory but the lighting and exposure are all we desire, we may make our picture at once. If not, we first try changing the facing of the model, in portraiture, or the



ORDINARY LIGHTING

ORDINARY LIGHTING

"REMBRANDT"

PROFILE

PROFILE

AGAINST-THE-LIGHT EFFECT

FIG. 5. Conventional arrangements of lighting for indoor portraits. Circle shows sitter, facing as indicated by arrow; C, camera; R, reflector; B, background; W, window.

position of the camera. Next we may alter the illumination by treatment of the windows, doors and the like. Third, we may try blotting out altogether by shades such objectionable lighting features as are apparent. Fourth, we may bring diffusing screens and reflectors into play. Finally, if we have failed so far for the result we want, we must pick another place. The situation appears, then, the beginning and ending of all. As a general rule we shall find that bedrooms and nurseries are better places for photography than the downstairs rooms. Being on the second floor their windows face the sky with less obstruction, their walls are usually lighter in tone and the ordinary white hangings, counterpanes and the like, render further material assistance toward reduction of the exposure. With regard to other buildings than residences we shall have occasion soon to consider the lighting facilities.

In Portraiture

In the matter of indoor portraiture the situation must be our first choice if either adequate lighting or practicable exposure length is to be assured. In an accompanying sketch (Fig. 5) are displayed the lightings of sitters which experience in home protraiture has determined of ordinarily superior value. In the securing of a short exposure-time with any one of these arrangements (which are given for reference, by the way, rather than for any inherent novelty), two considerations must be noted: the distance from the window which furnishes the chief illumination and the lighting of the shadow side of the figure. Closer approach to the window means reduction in exposure. Increasing illumination of the shadow side has a similar effect. A seventh position might be shown in which the camera is between the window and the subject, the contrasts in the face being thus reduced to a minimum and the briefest exposure made possible. This is a plan that often works well with children; but, while it offers a shorter exposure possibility and assists normally in an easier composition of background and surroundings, caution must be exercised against any prolongation of the exposure that would contribute to the flatness. This lighting is favorable for children's portraits.

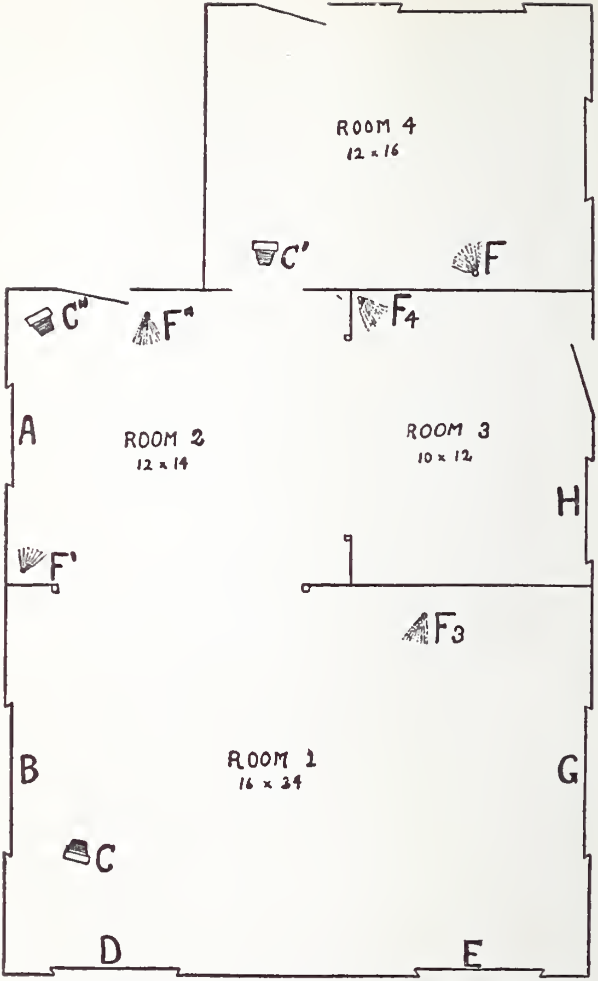


Fig. 6. A composite view of several common indoor lighting and exposure features. (1) With camera in position C: The windows A and H and the exterior door by the latter may be supplemented, if they do not sufficiently illuminate Room 2, by a flash at F′; like-

Corners In every residence (other buildings as well for that matter) will be found the dark corner for which exposure of any length seems insufficient. The stair-landing, which has been used with effect for bridal-couple poses, often has its landing window which will give us assistance with a prolonged exposure. Alcoves and vestibules often have such slight illumination as to render them almost impossible photographically. The best advice one hears for these places is not to photograph them at all, but the flashlight does offer one means of escape if they simply must be pictured. In such places, as well, the actinometer is of slight use unless one has several days to allow it for darkening. Since such places are naturally dark a thin negative is not a disadvantage, and our purpose should not be to expose long enough to give us such a negative as we would secure in a better-lighted place, but one that will in a measure indicate the natural gloom. In high-key portrait work, on the other hand, although a quick exposure is made possible by the predominance of highlights, we must take care that our exposure be ample to assure a negative that will not clog these lights; the key being full exposure and short development.

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wise, a flash at F could increase the lighting in Room 4; in each of these cases, under ordinary circumstances, the normal lighting ought to suffice. (2) With camera in position C′: The window D, and probably B, will have to be blocked out during most of the exposure if the light at them is at all strong in order to avoid halation; if this corner of the room is thus rendered too dark, an auxiliary flash may be needed at F_3; this position of the camera is often used to secure a longer view of the nearest room through a doorway which may or may not itself show. (3) With camera in position C″: Window E will now have to be darkened to prevent halation and dependence placed on B and G for illumination, though the flash at F_3 may again be employed if needed; if the lens is of a wide enough angle to include much of Room 3, the window H will also have to be darkened, in which case a weak or well-diffused flash at F_4 may become necessary. The flashes at F and F_3 should be kept, in the respective exposures, at least as far from the nearby doorways as is indicated in the sketch in order to soften their glare and equalize the illumination. In these rooms, as in every other, the flashlight should not be used except as a last resort, for reasons explained in the text; if the windows will give enough illumination, even by prolonged exposure, make them do.

Some Difficulties

The difficulty will become immediately apparent to the novice at interior work of adjusting his exposures to fit the varying degrees of lighting throughout his picture. (Fig. 6.) The near rooms may be light and the distant ones dark; broad sunlight falling upon the floor in some places may produce a dense black spot on his negative while the shadows remain almost without detail. His task will be in most of such cases, not to find an exposure that will cover all of these variations, but to strike such an average as will make the extremes least objectionable. If a distant room appears even brighter than the nearer one, its shades may be slightly drawn. If the sunlight threatens too great a variety the windows which admit it must be curtained. In portraiture where the whole figure is included in the picture, caution must be exercised that unevenness of exposure is not introduced by the light not striking high enough to illumine the face or low enough to brighten the dress to the floor. It is often possible, in the case of children who demand a short exposure especially, to contrive some sort of a platform to raise them from the floor and more directly in the light from the window. Mere inspection in the ground-glass usually will indicate which portions of the scene must be darkened by diffusing or inhibiting the light and which must be lightened by the opening of a door or shade or the introduction of artificial illumination. Especially must attention be called to the fact that the variation in lighting throughout the day affords us assistance to a very great degree. If our scene is illuminated by east windows chiefly, we may find its harsh contrasts, and the resulting long exposure, disappear when the sun has passed over to the west. A study of the situation under the lightings of different times of day will almost always indicate one best time of all.

Sunlight

One encounters very often the advice that direct sunlight has to be excluded from the scene at all costs. Its origin must have been in an older time when the quality of plates was inferior and when the handling of light and an appreciation of its actinic qualities were less sure.

The warning is nullified nowadays by so many excellent pictures wherein sunlight plays an important role that it must be relegated to oblivion along with many other outworn notions photographic. One who has seen the work of W. R. Bland, for instance, especially his superb "Wirksworth Church," with the sunlight streaming in by the chancel window, or many of the portraits which Coburn has made, one in particular of W. Child Bayley, the photographer writer, in which the sunlight just misses the subject's head, must appreciate the possibilities it offers. Photographs of interiors may even be taken directly through the sun's rays with safety. In the matter of exposure, it must be evident how great a value this proximity of the sunlight has. In portraiture it makes the briefest exposures possible. In general interiors its effect is similar and, since we are so accustomed to such lights in our homes, why need we be so very chary of picturing it, up to the point of serious interference with the composition and evenness of exposure of our subject? Individual discretion will dictate when the sunlight is to be admitted and when not, so far as artistic effect is concerned. With regard to exposure we must remember that it is apt to introduce harsh contrasts and that to compensate for these ample time must always be given or reflectors and diffusers employed to soften the shadows.

Window Portraits

The out-and-out "window portrait," with the subject seated right at the window and the exterior more or less distinct, has been admirably exploited in a previous number of THE PHOTO-MINIATURE, No. 118. It is only necessary here to repeat the warning that the harsh contrasts thus unavoidable indicate full exposure. The distinctness of the view through the window, since this is much more brilliantly lighted and necessitates much less exposure, is to be achieved, therefore, only by reducing the exposure on the interior part of the subject by one means or another. That usually suggested is the employment of a moderate flash. It will take some calculation to assure that the interior and exterior lighting are made approximately the same and thus that the exposure may include both. Portraits of babies are very often best secured close by a window, even though they are photographed from an angle thereto. One of the kodak books has a delightful portrait of a baby on a lounge beside a window, taken on a sunny day with a focal-plane shutter and the lens working at *f*/4.5 in 1-75 second. The opposite arrangement to this, where the photographer outside of the window desires to take a subject at the window but within the house, introduces some other complications of exposure. In general, this exposure must be nearer what would be given for an interior picture than what the outside conditions indicate. It must be noticed, however, that the situation is practically the same as an interior portrait with the camera between window and sitter (the latter having moved up to the former), that the lighting is similarly flat and that a decreased exposure is thus needed. Without the short exposure flatness must certainly result in this kind of picture. If the subject is turned at a slight angle to the window and a reflector used within the room a greater degree of contrast may often be secured and the exposure consequently somewhat lengthened.

Other Interiors

Thus far we have devoted our attention almost wholly to such interiors as residences offer us for photography. It becomes necessary now to consider other sorts that are less often met with, as churches, libraries, public halls, theaters, pergolas, arbors and verandas. The general principles which have been laid down must apply here as well as in houses, but there are some few additional points that deserve our study.

Churches

Churches have ever proved mightily attractive to the photographer. In a considerable measure, this was an inheritance from the Britisher and the Continental, who were in constant proximity to churches of historic and architectural importance that really left the photographer no alternative but to try them. American churches, until more recent years, have hardly come up to the standard, but today one finds attractions enough of the sort to induce him to the essay. For the most part churches follow conventional lines of construction, with the nave, the choir-loft, the crypt and, often, the cloisters appearing in practically all of those of metropolitan pretentiousness. Still the lighting, and consequently the exposure, varies materially from church to church, even in corresponding parts. Whether this lighting filters in through stained-glass windows or broad clear glass and skylights; whether the interior work reflects little light off its dull surface or much when the surface is light in color and varnished; whether columns introduce difficult shadows; whether the exterior light is bright and spotty or diffused: these all are details which must not be omitted from observation. The chief value of stained glass, which reduces the amount of illumination as we have seen, unless it is predominantly of the colors at the actinic end of the spectrum, is as a diffuser. In its absence few churches can be correctly handled on a bright day. The range of exposures then necessary is tremendous and the influence mentioned so emphasized as to complicate the problem too far. Choose the sunless day. If the ceiling is of dark timbers, assistance in shortening the exposure will be rendered by a covering of snow on the ground. If it is the lower half of the church which, as in many older edifices, is the darker, it will simplify the difficulty to shade the lens or even use a sky-filter, increasing the exposure just as if this were used out-of-doors. As a general indication of the time necessitated for such exposures, the following adaptation of Henry W. Bennett's tables for such subjects, reduced to the *f*/8 stop in the lens, brightest light and very rapid plate: nave, or general view, 10 seconds to 1 minute; aisles, if windows are of clear glass, 15 seconds to 1 minute; aisles, stained-glass windows, ½ minute to 2 minutes; choir, 1 to 4 minutes; crypt, 3 to 15 minutes; cloisters, 5 seconds to 1 minute.

Libraries

Public libraries, to insure their adaptability to their purpose as reading-rooms, are ordinarily well lighted with large windows on as many sides as have an exterior frontage, and the exposure for pictures therein is a comparatively simple matter. In the great majority of instances it will be surprisingly brief, but a fraction of that in the subjects we have just been studying. The "stacks," the shelves where the books are kept, usually are darker and lighted only at the ends unless artificially. There is seldom reason for taking these, and the only practicable way usually is to place the camera just within one end of a stack, preferably its darker end, and use a flash above and a little behind the lens. Libraries in residences, unfortunately for the photographer and, perhaps, for their users as well, are not so fortuitously lighted as a rule. They will be found often, however, to depart but little in their demands from the other rooms and to require similar exposures.

Theaters

The ordinary photographer is seldom called upon to reproduce a theater interior or any part thereof, and the lighting and exposure problems incident thereto he may usually leave to the professional. The latter will find his difficulties numerous. The fastest plate is always indicated, especially if actors on the stage are also to appear. Usually the resulting negatives, even with the exposure prolonged to the danger-point, will be found thin though with plentiful detail. Such subjects are best photographed when they are lighted both by the diffused lights in the "foots" and "skies" and by the spotlights from the "wings" as well. By the use of flashlight, these stage lights and a battery of special "spots" from the front the ordinary stage scene can be taken with a lens working at *f*/4.5 in about ½ second. Dressing-room scenes with the ordinary lighting there will take approximately 5 seconds. With the exaggerated lighting secured as just detailed, a scene in the Alhambra theater, London, recently was taken in 1-25th second from a box.

Verandas

Compared with interiors, veranda pictures may be taken with much shorter exposure because of the great increase in the light. This same wide opening to the sky, however, causes an exaggeration of the shadows which must be taken into account. If the benefit of the increased illumination is to be secured the shadows ought to be much decreased by adequate reflection. Halation from the light coming in at the end of the veranda which the camera faces must be prevented by screening that opening. Invention may be allowed full play in the handling of sheets or other white cloths to devise studios out of veranda situations, and the exposure rules will then approximate those of the ordinary professional studio. To prevent too harsh a glare from sun or sky it may often be found advisable to use the porch on the shady side of the house, if there is one. Conservatories under ordinary circumstances will be found too sunny for even lighting. Early morning and late afternoon hours, however, at times furnish more nearly proper illumination in these.

Auditoriums; Factories

Public halls, designed in many instances for night meetings chiefly, will often be found to have inadequate lighting by day and a long exposure is often necessitated. Most of such structures are usually designed, also, with high ceilings, introducing an added reason for extended exposure if these must be had. In all cases their appearance within the picture space is not in the least a necessity, and may be suggested merely by the appearance of the forward part of them in the end of the room farthest from the camera. The distance of this and its usually light tone will relieve much of the difficulty. Offices ordinarily are well lighted, though too generally from one side, and the small number of persons occupying them makes it possible to increase the exposure to 5 or 6 seconds if needed. Not so simple is the factory, where the large number of employees is almost certain to assure us some movement in even a brief space of time, and the lighting is not always of the best. In those factories which have skylights and window-space of any commensurate dimensions, it will be found possible often to keep the exposure to a second or two, unless the size of the room is so great that the lens must be stopped down to secure definition throughout. In other cases it is better to introduce one or more flashes than risk movement, for the pictures of such places ordinarily are taken for record rather than pictorial purposes and definition is the chief desideratum. The connected flash-bag system will be the most convenient.

Reflection of Light

The influence of reflection is more ubiquitous in interior lighting and exposure than appears at first glance. To a certain extent, both indoors and out, every object in front of the lens reflects some light if it appears in the negative at all. Experiments have shown that even black velvet reflects some light and matte black paper even more. Besides this fortuitous reflection from all objects, indoor photography introduces us at once by necessity to another kind of reflection, that which can be managed to the nicest detail and the chief purpose of which is not to throw added light rays into the lens but against those portions of objects in the picture that otherwise will prove too dark. From an artistic standpoint, in portraiture especially, such reflection is necessary to secure the roundness and modeling which are normally in the subject but which harsh contrasts distort out of all semblance to the natural. For our present purpose, however, reflection is of use in shortening exposures that otherwise would be too long and in reducing the length of the gradations in the subject to somewhere near the length which the plate can express. For instance, there is no possibility of computing an exposure that will at the one time adequately portray the brightly lighted window and the shadow behind the stove. There is no appraising such a range of gradations. Our only alternative is to reduce by diffusion the light from the window and soften by a reflector the shadow behind the stove until they both fall within the range that we can seize and record by adequate exposure. Again, the substances which compose the objects in an interior are immensely variant in their reflective power; some throw so strong an actinic light into the lens as quickly to impress their image on the negative; others respond so weakly because of their color or tone that they fail to take with the longest exposure. This is especially so in an interior where objects must necessarily stand so close to the camera and where their colors preclude the possibility of quick exposure. It is interesting to note in this connection just how much light, comparatively, is reflected off different substances. Here are a few cases in point:

Polished mirror, 95 per cent of the light which falls upon it; white blotting-paper, 82 per cent; newspapers, 50 to 70 per cent; yellow wall-paper, clean, 40 per cent; blue wall-paper, 25 per cent; yellow wall-paper, soiled, 20 per cent; brown wall-paper, 13 per cent; chocolate-brown wall-paper, 4 per cent.

Color as an Exposure Factor

This comparison will make it immediately evident to us how largely our exposure must be governed by the color of the objects toward which the camera is pointed and of the objects surrounding these and reflecting light upon them, whether the first or the second be walls or hangings, clothing or furniture or what not. Earlier in this discussion (see again Fig. 3) we had occasion to note that common plates are sensitive to a considerable degree to those colors at the violet end of the spectrum and to a rapidly decreasing degree to the colors at the red end. Orthochromatic plates, which are more commonly in use, are treated with certain dye-stuffs that, to a considerable extent, increase their sensitiveness to yellow and orange but still leave them almost unimpressionable by red. This is the reason that red glass is employed in our dark-room lights. Panchromatic plates are still further corrected and do react to a certain extent to the red rays. Now if the light reflected into the lens by subjects toward which it is directed is violet or blue, impression will be made upon the plate with considerable rapidity. This will be decreased somewhat with the yellow and orange rays. It will almost disappear with the red. The closer these difficult colors are to the camera the more the exposure must be prolonged, so much so that it has been estimated that the exposure for a room quite destitute of furniture may be reduced to one half what it would be if even light-colored furniture at a fair distance from the camera were present. This consideration of color may be more picturesquely stated in another way, and that is the following: To obtain in the negative the density a white object would give, colored objects must have an exposure as many times as long as this as the following: Violet, 2; green, 4; green-yellow, 30; yellow, 36; orange, 120; red, 1,600.

The same consideration extends to the clothing a person wears in an indoor portrait; the darker the clothing the longer the exposure must be. Still another fact must be noted here that darkness in color and tone are not always the same. A violet or blue object placed in a very subdued light may take longer to photograph than a similar orange-colored object in a medium light. Our exposure must be regulated by both of these conditions: the light that falls upon the object and the character of the light it reflects toward the lens. This is one explanation for the fact that the color of objects out-of-doors, except those close to the camera, while it may have much to do with tone has but little modifying influence upon the exposure. Out-of-doors the lighting is more equable throughout the view that is in front of the camera.

Light-Screens and Reflectors

We are prepared now to understand two reasons for the white cloth-covered frames of various sizes we are accustomed to have wheeled and switched about us in the professional studio. These are the reasons: they cut off reflection of walls and hangings of colors more or less lacking in actinism and throw upon the sitter the reflection of the highly actinic light from the blue sky without. They are used always on the shadow side because it is the shadows that lack the light and that must be softened if harsh contrast is to be avoided and the scale of tones brought within the limits of ordinary exposure. Though the use of reflectors in portraiture in ordinary interiors is more frequently employed than in the photography of the interiors themselves, judicious disposition of such adjuncts will often materially aid us in exposures of rooms that threaten otherwise to go beyond the limits of our plate and our patience. A white sheet over a stepladder or high-chair will often be just what is needed to permit its photography with the exposure that is meanwhile registering the rest of the scene. Mirrors will seldom do because the light from them is too harsh and concentrated, though they may be employed for special effects on occasions when this very concentration of the light is needed.

Their Use It is in indoor portraiture that we must give the most careful attention to the use of reflectors. The six sketches in Fig. 5 each contains a line to represent the position of the reflector, and it will be seen that in each occasion this is so placed as to catch up the stray rays from the windows and throw them back upon the face and figure of the subject. It will be deduced also, that if this reflector is moved toward the sitter (and hence toward the light) the reflection will be stronger, and if it is moved away the reflection will be weaker. Pictorial considerations tell us that one side of the face ought to be more distinctly lighted than the other, so we shall not move the reflector too close to the sitter; and that there must be sufficient detail even in the shadow side, so we shall not move it too far away. In regard to exposure, fortunately, the same treatment achieves the desired end. Adequate reflection into the shadow side of the picture makes it possible to obtain detail there with an exposure that will not be long enough to overexpose the lighted side. Of what substance the reflector shall be composed is chiefly a matter of convenience, except that it will be found that pure white reflectors are so harsh with a strong lighting as to have to be placed farther from the sitter to afford the requisite gradation. Cream-colored, light buff or light gray cloths will produce a softer and more easily handled reflection. Canvas, calico, muslin, bleached cotton, even sheets, towels and newspapers, suggest themselves as possibilities. They may, by the inventive photographer, be rigged up on specially contrived frames, but a stepladder or a stick with a crosspiece and the cloth suspended therefrom lashed to the back of a chair will serve admirably in emergency. Rather to the amount of reflection than to the character of reflector must we pay attention, and this is regulated by the size of the reflector, its distance from the subject and its angle to the light. As a general rule in portraiture we may say that when the lighting has been best adjusted by the reflector to bring out the roundness and character of face and figure it has been adjusted also to the most favorable exposure conditions.

While we are taking this regard to reflected light we must not relinquish caution against chance reflections. Most evident of these will be the light reflected from mirrors and pictures within view of the lens. Slightly changing the angle of these by tilting or turning them will usually insure a correction of the fault. Highly polished furniture, such as pianos and brass ornaments and fixtures are other sources of such undesired reflections, as well as the spectacles worn by portrait subjects. In flashlight work special care must be taken that these reflections do not intrude, and here the danger is more serious because, until the flash is set off and the plate exposed, we are not usually aware of the false light. Holding a candle where the flash is to be and sighting all bright surfaces from a level with the lens will protect us. The photographing of glassware and silverware in dining-rooms introduces a trouble of this sort in nine occasions out of ten. When possible a light, both from the main source and from the reflector, falling at a forty-five degree angle is to be secured. The exposure for such subjects must be sufficiently long to prevent glaring highlights and bad shadows.

Opaque Screens

The use of diffusing screens to reduce too strong a light from windows and doors has been already mentioned. It must be remembered always that these correspondingly increase the exposure. Besides screens that permit the light to filter through them, absolutely opaque screens may sometimes be employed with effect in interiors, placing them rather close to the light-source and permitting them to shade too brightly illuminated spots that otherwise would give too great density during the exposure we desire.

Supplemental Lighting

When shadows are encountered in interior work that can neither be lightened by natural illumination from the usual sources nor can be secured in the negative by even the longest exposure, artificial lighting must come to the rescue. It ought to come to the rescue under no less considerable an exigency, because it introduces at the very best unnatural lighting; it is difficult to handle, more difficult to harmonize with the natural illumination which it supplements, and most difficult of all to indicate, when thus used in conjunction with daylight, the proper exposure to be given. THE PHOTO-MINIATURE, No. 118, "Home Portraiture," No. 135, "Flashlight Photography," and No. 141, "Some Problems in Home Portraiture," besides that most helpful among recent numbers for the interior worker, No. 137, "Lighting in Portraiture," contain most of the information that anyone needs know about the handling of artificial illuminants. It is our purpose here merely to indicate and repeat some of the considerations which the matter of exposure emphasizes.

Flashlight Exposures

Flashlight reverses the usual factoring of exposure. By daylight, we estimate the illumination and guage the exposure to fit it; by flashlight, we keep the exposure constant and use enough of the flash material to fit that. Exposure then is reducible to more or less mathematical rules. The source of the flash is limited to a very small point and the sphere of illumination is a solid angle subtended by that point; it is a cone of light, in other words, with the flash at the apex. Manifestly not the covering power of the flash but its intensity is increased by increasing the amount of powder. Carrying our reversed comparison with window-lighting farther, we find that the amount of flash material needed will be regulated by the aperture, speed of the plate, the nature of the subject and the amount of detail sought. Moreover, with the flashlight as with daylight, the further it is asked to illuminate the less brilliant will be its response. This introduces the need of supplementary flashlights at times, placed behind protecting partitions, posts or pieces of furniture for lighting the farther spaces of our subject. If behind partitions, the farther these are placed away from the portion of the scene before the lens and still light it sufficiently the better, as this distance will insure better diffusion and less harshness and danger of unnatural lighting. (See Fig. 6.) Diffusing screens will usually be needed for portraiture by flashlight; less often for general interiors. The general rule that as a diffuser of ordinary light thin cloth intercepts about one third of the rays, will give an indication of by how much the exposure should be extended. Portraiture by flashlight introduces the novice to the most difficult use of this difficult illuminating medium, and I earnestly beg the prospective user of it to refer to the PHOTO-MINIATURES of which the numbers are given above before he makes his attempts.

Flash Powders Magnesium ribbon is among the safest and most easily handled of all flashlight materials, and after it the flash-sheets come a close second, but neither nearly equals in power the flash-powders. The flash-sheets are accompanied by directions that indicate exactly their capabilities. Magnesium ribbon is best used for supplementary lighting and the amount depends upon the distance from the camera and the other factors just mentioned. In its employment diffusion is simply achieved by moving it about while it is burning, only keeping it out of view of the lens. Several tables are available to indicate the amount of flash material needed for different rooms. For the ordinary flash-powders, such as Eastman, Luxo, Sunlight and S. & M., the following will indicate approximate amounts:

FLASH-POWDER AMOUNTS

Distance of Principle Object	Character of Furnishings	Amount of Powder in Open Lamp
6 feet	light	¼ teaspoonful
6 feet	dark	½ teaspoonful
10 feet	light	¾ teaspoonful
10 feet	dark	1 teaspoonful, level
15 feet	light	1 teaspoonful, heaping
15 feet	dark	2 teaspoonfuls, level
20 feet	light	2 teaspoonfuls, heaping
20 feet	dark	3 teaspoonfuls, level
25 feet	light	3½ teaspoonfuls
25 feet	dark	4 teaspoonfuls

Magnesium In using pure magnesium, the following amounts have been suggested: Farther wall 10 feet distant, 1 teaspoonful; 15 feet, 2 teaspoonfuls; 20 feet, 3 teaspoonfuls; 25 feet, 4 teaspoonfuls. F. J. Mortimer suggests the following amounts of magnesium for portrait work where the subject is in light clothes and is at the respective distances given from flash: 5 feet, 12 grains; 10 feet, 30 grains; 15 feet, 70 grains; 20 feet, 100 grains. For flash-powder used in larger rooms than those indicated above the following table may be consulted:

FLASH-POWDER AMOUNTS. Table No. 2

Dimensions of Room	Grains of Powder
30 x 12 x 10	120
40 x 15 x 10	230
60 x 20 x 12	460
70 x 30 x 15	680
90 x 40 x 15	1,028
100 x 45 x 20	1,340
130 x 60 x 20	1,850

These tables have each been reduced to the conditions of very rapid plates (200 H. & D.) as previously noted and *f*/8 aperture, with the approximate instantaneousness of flashlight taken into consideration.

Other Artificial Lights

Much interesting work has been done by other artificial light than flashlight, by arc and electric lamps, for instance, and even by gaslight. The amount of exposure under such lightings is extremely difficult to determine except by sheer experiment. Any comparison of the illumination given by different apparatus but lends confusion to the subject. We may be told, for instance, that sunlight equals in intensity 5,600 candles at 1 foot from the subject, and that the electric arc light per candle-power is equivalent to 10 standard candles, without knowing much more about what exposure to give than we did before. A single arc of 2,000 candle-power illuminating a room 40 x 25 feet will demand an exposure of from 2 to 3 minutes with very rapid plates and the lens working at *f*/8. The arc lamp, if brought close to a sitter, needs diffusion, but the consequently extended exposure may be again reduced by a reflector behind the lamp. The actinic power of the ordinary gas-jet is very small, but that of the incandescent (Welsbach) burner is greater than of an incandescent electric lamp at the same candle-power. An indication of what may be done by artificial light, excepting the arc, is afforded in the following examples, chosen at random, and the figures reduced to the uniform data of very rapid plates (200 H. & D.) and the lens at *f*/8:

Two gaslights, not incandescent, 3 feet from sitter wearing medium light gown. Light reflected into lower part of face to small degree by magazine. Exposure, 2 minutes.

Child asleep in crib, much reflection from white sheets, etc. Single gas-jet in ground-glass globe 4 feet above child's face and a little to one side. Exposure, 2 minutes.

Lady reading by ordinary lamp with "Rochester" burner. Face partially in shadow. Exposure, 12 minutes.

Room 16 feet square, lighted by three gas-jets normally and extra lamps to throw light into dark corners, hidden from camera. Exposure, 19 minutes. Some halation about lights and shadows somewhat abrupt.

Supplementing Daylight

The value of artificial light as an assistance to natural illumination will early be demonstrated to the interior worker. In every interior we have found dark corners to exist which no length of exposure will secure. In others, the lighting is so unequal that the ordinary illumination gives us here a patch of light and there an impenetrable shadow. For the dark corner and this shadow without any detail the flashlight will be of considerable assistance. Often no more is needed than a bit of magnesium ribbon, held in a pair of pliers and over a dustpan and moved about where it will throw light into the dark corner but not upon the open lens. In a church, for instance, a few inches may be burned in a crypt or behind a pillar beyond which too dark a shadow lies. It is to be insisted that the natural lighting should be employed wherever it is at all possible, and that the flashlight should only be used as a makeshift. It is bound to introduce, except with the most careful and experienced handling, so unnatural a lighting as to arouse the disapproval of other than technically versed critics. But, as a last resort, do not be afraid to use it. Keep the amount reduced to the lowest possible that will give the illumination and exposure desired and keep the flash itself as far removed as may be from the direct vision of the lens that its lighting may be the more diffused. Wherever possible the flash-rays should travel in the direction of the normal light-rays even if distantly removed from their source.

Indoor and Outdoor View Combined

There is one situation where the flash is of considerable assistance and that is in subjects wherein it is desired to show both the interior of a room and the scene without. Several methods of doing this have been found practicable. First, there is the plan of setting off a flash behind the camera, the window being uncovered, and interior and exterior photographed at the same time. The flashlight so illuminates the interior that the exposure may be equal for both parts of the subject. How much flash must be allowed it is difficult to determine, but a judgment may be based on an accurate calculation of the exposure requirements within and without the room. A second method is to take a flashlight photograph of the interior by night, using the customary amount of flash-powder. Then close the lens, leave the camera in place over night, after clearing the room of smoke, and in the morning open the shades and take a brief exposure for the out-of-doors. This method is rather cumbersome and requires, above all, locking the door of the room over night to prevent disturbance. A third method, where there are at least two windows, is to block up with an opaque paper the window through which a view is desired. Give an exposure of about nine tenths the time the room requires by the remaining light. Close the lens, uncover the window and give an additional exposure for the remaining tenth of the time to secure the exterior. The second method may, of course, be reversed, taking the exterior by afternoon light and leaving the camera until evening when a flashlight picture for the interior may be taken.

Retrospective

It will be well before we approach the end of our subject to glance back at the faults which we have occasionally mentioned as attending incorrect exposure indoors.

Chief among these, of course, is under-exposure. In first attempts at indoor photography this will result from under-estimates of the light-values. The beginner will do well constantly to keep tab on the ratio of surface presented by the window which furnishes his light to the whole wall-surface of the room. That one observation will ordinarily impress him with the necessity for an immense increase in the exposure over out-of-doors where this larger surface would all represent light-source. Later, under-exposure will be apt to result from the employment of a small stop for the purpose of securing depth of focus, i. e., sharp focus on near and distant objects. The ratio of exposures paralleling the ratio of stops must here be kept in mind. If we compute an exposure for the *f*/8 stop and reduce the stop to *f*/32 we must remember to give sixteen times the exposure computed. It is a question which must be left to individual judgment as to how much absolutely accurate detail is needed throughout an interior and how much diffusion will serve perhaps more accurately to mirror the interior as it appears to our eye. Personally, it has seemed to me with regard to many interior pictures observed that they would have benefited notably by such a softening of the distant portions as a larger stop would have given. Finally, every possible caution against under-exposure in interiors must be taken. Out-of-doors it is bad enough. Indoors, with the immense range of light and shade, it is positively fatal. Over-expose indoors always rather than under-expose.

Correct Exposure

Once more, correct exposure is an absolute requisite if we are to obtain a correct rendering of the gradations in our subject, and the length of these gradations makes indoor exposure even more difficult again than outdoor. Cassell's "Cyclopædia of Photography" gives this comprehensive definition of gradation: "That variation in a print (or negative) by which are suggested differences in color or in light and shade; a print (or negative) has a long scale of gradation when there are many intermediate tones between the deepest shadow and the highest light." Such a long scale is unavoidable in nine out of every ten interiors. We found early in this discussion that incorrect exposure gives us incorrect gradations; that under-exposure makes the light tones too light and the dark tones too dark while over-exposure runs them all together in a flat, dreary drab. Of the two faults the former is the worse and the more common within doors. It is to be obviated only by correct exposure; no subsequent treatment can restore the normal values to the several tones in an incorrectly exposed negative. From the practical standpoint, the idea indoors should not be to cut down the amount of light but to keep it diffused, mellow and as widely distributed as possible. Exposure may be made when the lighting conditions give slightly less contrast than desired more safely than when the contrast is heavier than desired. Positions should be taken to photograph across the light from its source rather than directly toward the latter. Excessive contrast is more easily controlled by altering and softening the lighting than it is later. It must be remembered in all cases that the stronger the contrast the more care we must exercise to secure as full an exposure as the limit of the plate will permit. When, subsequently, we approach the development thereof, the rule which Alfred Watkins has been to so much pains to promulgate, that contrast is secured by prolonged development and flatness by reduced, will stand us in good stead. But use every precaution to reduce the contrasts to a normal condition in the original. Plates give us a considerable latitude in the rendition of tones, but too much must not be asked of them. If the scale of tones in the subject is longer than is possible in the negative, some of them must suffer. In such a case the darker tones will result in the negative in patches of clear glass, because even those less intense than the deepest will have approached that deepest during the exposure given, and the lighter masses, also running together, will give us dense black deposits in the negative without detail.

Halation

Though halation is intrinsically not a fault of exposure but of light-arrangement and the limitation of plates, it may not be amiss to refer to it briefly here. Halation is the fogged appearance often encountered in interior pictures surrounding bright spots in the original. It is as if the light had escaped around the sides of the windows in the field of view and the escaped portion had impressed its image on the plate, too. It is a fault that seldom appears in film negatives because the condition which causes it, the reflection of light off the glass support into the sensitive emulsion with which a glass plate is coated, does not exist in non-glass negatives. Moreover, specially prepared plates are now easily secured, backed with a preparation which kills this reflection, and they ought always to be used, or such a preparation applied to one's own plates, when interior photography is essayed. Even then some halation may at times obtrude but it will not usually be a defect; in fact, the eye itself discerns some slight spreading of the light about a bright window from a very dark interior and does not find it disagreeable. Rays of light that strike the plate at right angles pass right through without this reflection, so that increased obliquity to the bright light-source causing the halation will often exaggerate the fault.

Light Tables

The value of the actinometer in interior work has been previously mentioned as well as the hardly explainable fact that, in spite of this worth, it is so little used. Without it the photographer is thrown back upon his own resources of experience and judgment, and this in the face of variations in conditions almost as wide as they possibly could be. Out-of-doors the photographer may depend upon either actinometer or experience just as indoors, but he is provided as well with tables and calculators of various sorts which are simple in form, easy to use and go a long way toward materially assisting him in his task. Such tables, for instance, are those printed in various photographic magazines and annuals. For interior work he is not similarly provided to any degree of comprehensiveness. It will be our remaining task to provide him with tables as nearly perfect as the widely variant conditions under which he works will permit. It must be warned at the outset that similar tables for exterior work are proverbially only partially satisfactory, not only because conditions are so variable but also because individual judgments regarding them are so apt to err; that the former element is more exaggerated within doors and the latter not less so. These difficulties contribute to the smallness of number of such tables which have been offered to the photographic public. Henry W. Bennett, to whose work we have had occasion previously to refer, has made some progress in this line, especially with church interiors. W. K. Burton's tables contain brief reference to interior work. The Eastman Company prints a general guide in a short table in its manuals. These may be here reprinted for quick reference, reduced in each occasion to apply the very rapid plate (200 H. & D.) and a lens working at *f*/8.

BENNETT'S TABLE

Ordinary rooms in modern houses	15 seconds to 3 minutes
Workshops	7 seconds to 1 minute
Same with skylights	3 to 6 seconds
Portrait in well-lighted room	2 to 6 seconds
Still-life, flowers, etc., in window	2 to 15 seconds

BURTON'S TABLE

Fairly lighted interior	20 seconds
Badly lighted interior, up to	4 minutes
Portraits, good studio light	2 seconds
Portraits, ordinary room, up to	8 seconds

More complete are the Eastman Company's tables which, reduced to *f*/8 stop and a very fast plate, are as follows:

EASTMAN TABLES

Wall-Tones	Windows	Bright	Hazy	Cloudy Bright	Cloudy Dull
White	2 or more	1	2	4	8
White	1	1½	4	7	14
Medium	2 or more	2	5	9	18
Medium	1	3	7	14	28
Dark	2 or more	5	10	20	40
Dark	1	10	20	40	80

Above times are all given in seconds.

Bennett's tables for exposures in churches have been previously summarized. Platt gives the following hints: Window portraits—sunny, 8 seconds; diffused light, 16 seconds; dull, 24 seconds; very dull, 40 seconds; gloomy, 60 seconds. Interiors, upward of the following—sunny, 10 seconds; diffused, 12 seconds; dull, 20 seconds. More variation!

Putting Things Together

If we keep constant the factors of a lens working at *f*/8 and a very fast plate (200 H. & D.), we find our remaining conditions to be included in any table to consist of the following: the color of walls, hangings, carpets, furniture, clothing worn by portrait subjects, etc.; the windows, their size, height, distance from subject, outlook, aspect as regards the position of the sun, etc.; the distance of the nearest window or windows from the subject, and the considerations common to all kinds of daylight photography, viz., the time of year, time of day and the sky conditions. In computing the tables which follow, a dark room is considered to be, for instance, one finished in the now popular weathered oak with its usual lack of varnish, the dull-finished and dark furniture that goes with it and the similarly dark-toned hangings. Red carpets and hangings would contribute to the innate characteristics of such rooms. Other oak finishes than the weathered are usually surrounded by plastering and other accessories that make them but medium dark rooms. Mahogany finishes would, however, come in the first classification. Light rooms would be those that had white or very light walls and hangings, such as we may find in many modern dining-rooms and ivory-finish drawing- and ballrooms, or light blue finish, as is presented in many boudoirs. Garments worn by the sitter rule the lightness and darkness similarly to these. Furniture particularly close to the camera, unless of the very lightest tone, will contrive to darken the subject. A window, as understood in the tables, is 25 square feet of clear glass, fully exposed to the light of the sky and not shaded by trees, vines or neighboring houses. If the whole window is diffused by screening the exposure must be increased about one third. Since the number of windows is taken care of more or less adequately in a separate classification, the light falling upon the subject from the nearest window is to be observed for the factor in the third division of the appended tables. Such tables might be constructed, so far as their mere form is concerned, in many different ways. This is divided into six considerations as recently mentioned. Against each is given a factor, the sum of all six of which factors, applied to the second division of the table, will indicate the requisite exposure. In the second division, excepting from "31" to "37" inclusive and beyond "40," the figures indicate seconds; there they indicate minutes and seconds.

Table for Indoor Exposures

Division I

Walls and Hangings—		*Time of Year—*	
Light	1	March 15 to August 15,	1
Medium	2	August 15 to March 15,	2
Dark	3		
Windows—		*Time of Day—*	
One	3	8 a.m. to 10 a.m.	2
Two	2	10 a.m. to 2 p.m.	1
Three or more	1	2 p.m. to 4 p.m.	2
Distance Nearest Window—		*Weather Conditions—*	
One foot	1	Bright	1
Four feet	9	Hazy	2
Ten feet	21	Light clouds	3
Sixteen feet	33	Dark clouds	4

Division II

6..½″	15.. 5″	24..13″	32..1′ 30″	40..30″
7..¾″	16.. 5″	25..14″	33..2′	41..1′
8..1″	17.. 6″	26.. 3″	34..3′	42..1′ 45″
9..1″	18.. 7″	27.. 8″	35..4′	43..2′ 45″
10..1½″	19.. 8″	28..15″	36..5′	44..4′
11..2″	20.. 9″	29..30″	37..6′	45..5′ 30″
12..3″	21..10″	30..45″	38..6″	46..7′
13..4″	22..11″	31..1′	39..15″	47..9′
14..4″	23..12″			

An Example

We have to photograph a room about 20 feet long and 14 feet wide lighted by five windows, two of which are directly in front of the lens and need to be blocked out. The room is finished in dark oak with blue "sunfast" curtains and dark furniture, some of this rather close to the camera, the window nearest the darkest part of the room. The distance is some 10 feet therefrom. It is 11 o'clock on a September morning and the sun is slightly veiled by a haze. We find our several factors to be as follows: Dark walls, 3; three windows, 1; distance of nearest window, 21; date, 2; time of day, 1; weather conditions, 2; total, 30. The exposure-time given in the second division above for this total is 45 seconds.

Warning

Once more the warning must be given that such tables as these, by the very uncertainty of the data with which they have to deal, are open to innumerable variations. The best they can offer, the best that is claimed for this, is an approximate idea of what the exposure ought to be. I want to impress upon the reader, finally, that this very uncertainty, far from discouraging him from indoor work, ought to tempt him to frequent and repeated essays until his experience has ripened to such a point that he goes about adjusting his exposure more or less mechanically. Lastly, if he must err, let him err rather on the side of over-exposure than under-exposure; seek diffused, mellow light rather than concentrated; shorten the scale of gradations by every means that will soften glaring highlights and dense shadows; make use of diffusing screens and reflectors generously but of artificial lighting as an adjunct to daylight only in emergency, and miss no opportunity whatever for putting his growing ability to the test.

ROY HARRISON DANFORTH

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Photographic Apparatus Made at Home

In the last analysis, and by the most rigid refinements of classification, one may divide all the people of the world into two classes: those who love to handle tools and make things of all sorts for themselves—and those who don't. This much being settled, let me frankly confess that I am one of those who don't. Let the cobbler stick to his last, said I, when someone would fain have me spend my Saturday afternoon making a color-screen holder or some other fascinating and eminently useful device which could be bought at a price from the nearest dealer. But the other man has been insistent and I have given way in the following pages, devoting a whole number of THE PHOTO-MINIATURE to a collection of methods and diagrams for making things, sufficient to keep the aforesaid other man busy for, let us say, the rest of the year. These methods and diagrams have been taken, with due acknowledgment, from the pages of other photographic journals, and so have already received the editorial approval of men better fitted than I to gauge the tastes of home craftsmen. I have chosen such inventions and devices as are likely to be of service to the greatest number of readers, everything included here having been asked for by at least a dozen correspondents at one time or another.—EDITOR.

A Brownie Working at F 4.5

The great convenience and simplicity of the well-known Brownie camera, perhaps the most popular of fixed-focus cameras selling at $1, has led many to attempt to equip the camera with one or other of the many high-grade lenses of short focal length, and thus do away with its single disadvantage—the limited capacity of its simple meniscus lens working at *f*/11.

A successful modification of the Brownie along the lines mentioned was described and illustrated in "Photography" a few months ago by I. F. MacLeod. As a first experiment, Mr. MacLeod fitted a rapid anastigmat and high-class diaphragm shutter to his Brownie. This proved so successful in use that he went a step further and added a focusing device and a direct-vision view-finder, obtaining by this last modification an outfit in many respects equal in capacity and convenience to an expensive reflex camera. I quote Mr. MacLeod's account of his experiments, which, with the diagrams, will enable the reader to make practical use of the suggested modifications, if desired.

Having recently bought a 4¾-inch Ross Xpres lens in a Koilos shutter, it occurred to me that, from an economical point of view, it would be a good idea to fit it to a No. 1 Brownie.

A three-inch lens is fully short in focus for 2¼ x 2¼ size, and gives a rather small scale image, even for enlarging; so it seemed to me that the 4¾-inch lens would be preferable, the angle included being about 26°. The alterations needed on the Brownie were exceedingly simple, and Fig. 1 shows the camera completed.

The detachable cardboard front of the Brownie was first taken off, and all the fittings on the wooden panel below removed, leaving it clear, with only the *f*/11 aperture in the center. This was next widened with a round file until it was about 1¼ inches in diameter. A piece of ground glass was cut and placed exactly where the film should go at the back of the camera. Then, by holding the lens (in the shutter) in front, I found that, when the back of the lens mount touched the front, objects 18 feet away were in sharp focus. I therefore sunk a circular rebate round the hole just made, so that the lens could be placed a little nearer the ground glass. It was reckoned that 30 feet would be the best distance at which to set the *f*/4.5 lens, and when an object at this distance was focused, the shutter flange was found to be exactly a quarter of an inch away from the front.

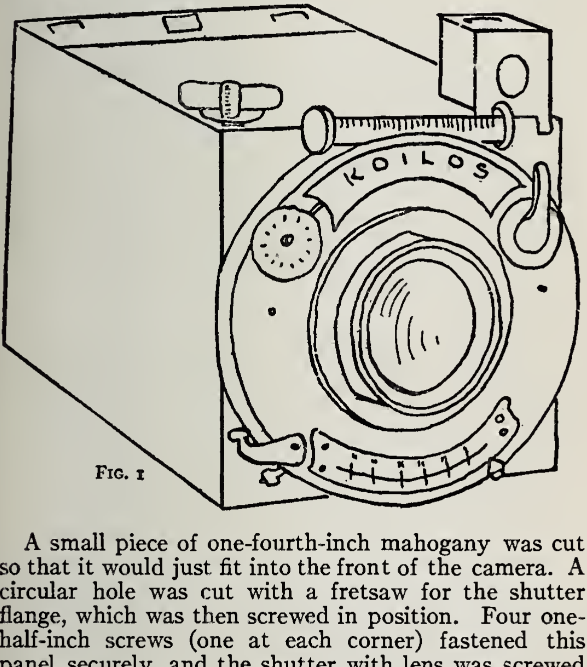


FIG. 1

A small piece of one-fourth-inch mahogany was cut so that it would just fit into the front of the camera. A circular hole was cut with a fretsaw for the shutter flange, which was then screwed in position. Four one-half-inch screws (one at each corner) fastened this panel securely, and the shutter with lens was screwed in. When tested with the ground glass, it was found to be correctly focused at 30 feet.

As the mahogany did not look well beside the leatherette of the camera, I cut the cardboard front, which had been removed, so that it would just fit around the flange. This was then seccotined firmly on. (Seccotine is an English adhesive similar to fish glue or china cement, obtainable in America from W. C. Cullen, 61 William St., New York. Editor.) As it was just a trifle thinner than the flange, the shutter could still be screwed in to the same extent. The front of the camera was now finished.

On examining with the ground glass again, it was seen that the corners of the picture were cut off by the edges of the circular hole in the wooden front of the roll-holder. This aperture was accordingly cut square, and the deficiency vanished; leaving the camera complete, with an *f*/4.5 lens and a high-speed shutter.

In order to make the camera more useful, I procured several spectacle lenses, which, when fitted in cardboard hoods, enable me to focus objects at various distances. To get buildings in the distance dead sharp, it was necessary to stop the lens down to *f*/8; but such work would be done only in summer, and *f*/8 would be ample aperture for snapshots then. The spectacle lenses were so long in focus that there was no perceptible interference with the fine corrections of the Ross Xpres lens.

After having the camera out once or twice, I was surprised and delighted at its efficiency. The only thing against it was the nuisance of getting out the appropriate spectacle lens, which had to be carefully dusted each time it was used. The apparatus worked so well, otherwise, that I determined to try another method of focusing, which is described below.

The results which were obtained with this model (shown in Fig. 2) were first class, and equal in quality to those taken with a quarterplate reflex, which I have used for the last three years. It will be admitted that animal photography will test most cameras very thoroughly. Well, at the Zoo I obtained photographs perfectly focused by scale, the animals being as near as five or six feet. If this is possible, I see no need for the bulky reflex and clumsy dark slides. It was only when trying to take animals as close as three or four feet that judgment in focusing failed. As the aperture used was *f*/4.5, this was not very remarkable, and it seems to me that even this error could be reduced after a little practice. After using a reflex for a year or two, one's ideas of distances are about at their worst.

The camera has quite a number of points in its favor. It is exceedingly simple and economical to work, the films costing only thirty cents per dozen (two spools of six), whereas one dozen 2½ x 3½ backed plates cost fifty-five cents. Of course, one must compare backed plates with films. Then the camera has all the advantages of the daylight loading system—"the all-daylight way"—and the weight is only twenty-four ounces when loaded and carrying a long metal lens-hood."

A Second and Better Model

With the second and further modification which follows, the size of the camera is slightly increased to 5¾ x 4 x 3⅜ inches, which includes all projections. This fits the No. 2 Brownie case. It is even thus smaller than any reflex or focusing box-camera and has of course the advantage of lightness and portability. The method of making the further modifications suggested is given by Mr. MacLeod as follows:

The camera consists of the Brownie, with a light wooden box into which it slides. Small bellows (2 in. ext.) were fitted on to the front of the Brownie, from which a quarter of an inch had to be removed for their accommodation. A small hole was made in that side of the bellows which would be farthest away from the light in the finished camera, to enable air to pass when the camera body moves in or out, and thus avoid suction. The sides of the box are made of one-eighth inch wood, and the top front, and bottom of one-fourth inch wood. The best material for this purpose will be found to be mahogany, which can be bought already planed, as for fret work, at 15 cents per square foot.

Before starting the fitting of the box, I gently flattened the outside of the Brownie, which was to be inside the box, with the aid of a large flat file. The corners seem to have a double covering of leatherette upon them, and, after this had been gradually removed, the body of the Brownie was found to be perfectly square. The fitting of the box was then done in the following way:

First the bottom of the box was measured and cut with a little extra margin. In the same way the left side was cut. These were then screwed together with three three-eighth-inch screws. Of course with such thin wood the holes have to be carefully drilled first and countersunk, otherwise the wood would certainly split. The Brownie was then laid in position, and the top piece measured and cut as before. This was screwed in a similar manner, but so that the Brownie could just slide backward and forward quite smoothly without any vertical play.

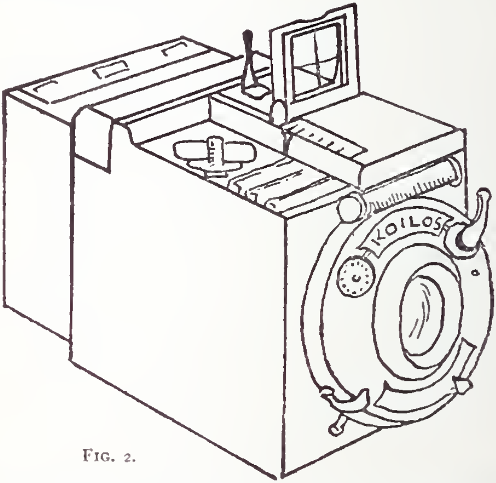


FIG. 2.

The right side had next to be fitted, and, as there was some margin on the top and bottom pieces, this was carefully pared down till practically flush with the body of the Brownie. The right side of the box was next measured and cut, and then screwed in position. The movement of the body was found to be rather stiff, but a little French chalk put this right. When this had been done the movement was as smooth as that of a focusing mount. I should add that the wood had been carefully sandpapered, and was exceedingly smooth.

The front had yet to be fitted. This was cut so that it would fit exactly into the front of the box. A circular hole was cut with a fretsaw to take the shutter flange, and when this was screwed on in proper position the panel was let into the front of the box and tapped until absolutely parallel with the camera back. When this was found to be the case, it was screwed firmly in place.

Before letting in the panel, the front of the bellows was covered with seccotine, which seems to be the best adhesive for that purpose, and immediately the panel was screwed in position the fingers were inserted through the hole, and in that way the bellows were pressed into good contact all round.

The next thing to make was the focusing scale. A little piece of ivory (the maker's name-plate from a piece of furniture) was filed down to convenient size, and sunk into the top of the box, as shown; but first a small screw was set in the top of the camera, as shown. The slot in this screw would act as pointer for the scale, being just below the ivory plate, and partly under the edge. By the ground glass already mentioned and a measuring tape, I was able to engrave the scale exactly, from "2ft." to "inf." The engraving was easily done with a sharp dissecting needle. India ink was rubbed over and cleaned off, leaving the figures and lines clearly marked in black.

A direct-vision view-finder was fitted, and a piece of brass strip across the weakest part, as shown, to strengthen it. A tripod bush was sunk into the bottom of the camera, and the whole given a coat of semi-matt varnish (black). This completed the camera.

I have seen it argued that an *f*/4.5 lens cannot be used with success on film, because of the tendency to buckle which the film possesses, causing the various parts of it to be no longer in the same plane. But although this may apply to film in quarter-plate size or larger, I do not think it does to so small a size as 2¼ x 2¼. At least no discrepancy can be seen in any of the negatives I have taken so far with the Brownie.

The camera, after it has been altered in the way described, is very suitable for figure work, and a long lens hood can be used without cutting off any of the picture. Thus photographs can be successfully taken with it very much against the light.

High-speed work is also quite possible. I tried the camera on a train traveling at about forty-five miles per hour, and at thirty yards distance. The highest speed (one three-hundredth nominal) was used, and the result was perfectly sharp, although, of course, it was inevitably under-exposed at the time of year when it was done—winter.

The camera is simpler to use than any focusing camera I know of. When the body is pushed right home, it is focused for infinity; in the illustration it is focused at three feet. For any other distance one has only to pull the body out, and it remains exactly where put. It has one distinct advantage over the reflex—that of giving slow instantaneous exposures. Moreover, when using my reflex I found that even for rapidly moving objects I never required or used the focal plane shutter at a higher speed than the five-hundredth part of a second. Surely then, on the whole, the Koilos shutter is more advantageous than the focal plane, at least from a practical view point.

As the diaphragm shutter I have opens far beyond the *f*/4.5 stop, I suppose that, even on theoretical grounds, it is as efficient as the focal plane. As will be seen from the illustration, the finder is masked at the ends so as to give a square picture.

The only fault the camera has, so far as I am aware, is the lack of a rising front. But, of course, that could easily enough be fitted, although it would take away somewhat from the simplicity and stability of the camera. As these two features are the strongest points in favor of the Brownie, few readers will care to add this improvement.

A Wire-frame Direct-vision View-finder

The advantages of the simple, wire-frame, direct-vision view-finder found on the best imported hand cameras are manifold. Such a finder, like the mirror of the reflex camera, gives us the full subject, right side up, as seen from the level of the eye, just as it appears on the focusing-screen or plate, right up to the instant of exposure. The following method of making a view-finder of this type for one's own hand camera is given by C. A. Harris in a recent issue of "Camera Craft."

"The construction is quite simple. It is desirable to have something that shall be contained within the camera, something not necessitating the carrying of a separate parcel. Begin by seeing what facilities the camera affords for accommodating the wire frame. I found there was space in the recess between the ground-glass and the door in the back of my camera to accommodate the frame proper. The two struts and the upright sight-bar I put in a small manila envelope, secured by a rubber band, and when the bellows are folded this is tucked in beside the lens. One should look into this first, because it may decide the exact size of the frame. This remembered and considered in the making of the finder, the balance is detail.

Important Points

"First in importance is the centering; second, the size of the frame and its distance from the eye when the latter is at the plane of the sight-bar, this distance regulating the amount of view included within the limits of the wire frame. As to the last, the ideal size is one that, when in position on the camera, will be an agreeable or comfortable distance from the eyes; that is, so there will be no blur. One had best experiment, beginning with, say, 3½ x 4¼. If the dimensions differ from those of the plate used, simply remember to get the right proportions by altering one of the dimensions. A finder of the above size would be just suitable for a 6½ x 8½, but would have to be made a quarter of an inch narrower for a 5 x 7. With the vest-pocket camera, however, I foresee that one would be obliged to carry the finder in a separate parcel.

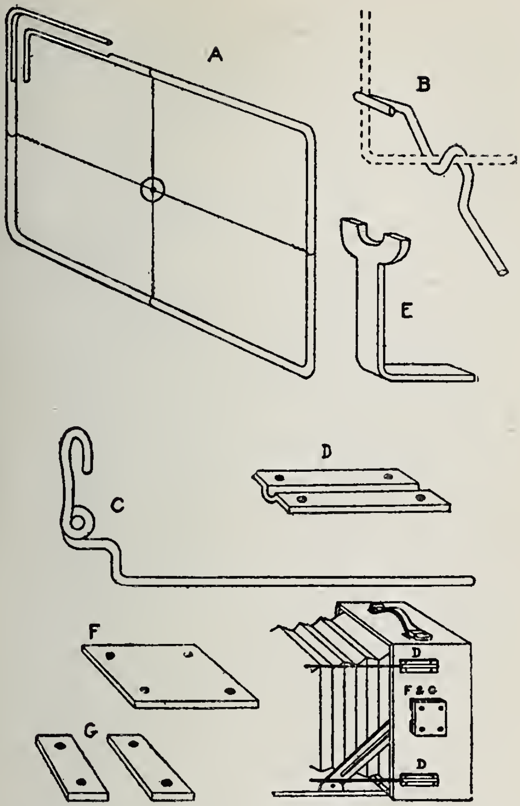
The Frame and Struts

"The frame is made of brass wire sufficiently rigid to retain the shape—the lighter the wire the easier to manipulate. The Sketch A shows the joint made at a corner by overlapping the two ends after flattening both with a file where they overlap and finishing by winding with wire thread. The center of the frame is now marked with a brass disc, one quarter inch in diameter. In the center of this disc make a hole just sufficient to admit the four wire threads which are extended from this point to the center of each side of the frame. File slight channels at the exact center of each side of the frame, which will hold and prevent the attached wire thread from slipping. This completes the frame proper.

"We are considering a hand camera of the folding pattern, one using an oblong plate. We will find that the nearer our frame is kept to an imaginary line drawn through the center of another such line extending the axis of the lens, the better, so this finder is best fitted to the long side of the box; that is, to the top when a horizontal view is on and from the side when a vertical one is being made. The frame completed, two struts, one shown at both D and C, are next in order. The one not shown of course twists in the opposite direction. As the drawing B makes plain, these engage the two lower corners of the frame, and when in position on the camera, hold it securely in position. These detach themselves when slid toward their respective ends of the frame ready for stowing away. The long, straight ends are inserted into sockets, D in the sketch, made of tin, bent around the wire and are fastened inside the camera box as shown by dotted lines on the camera-box side. This gives us the frame supported by the wire struts attached to the camera.

The Sight-Bar

"It will also be necessary to provide a vertical sight-bar or upright as shown at E. This and the slot-forming pieces, F and G, for attaching it to the camera, are cut from the brass of an extra-wide picture-hook. The diameter of the semi-circle at the top of this sight-bar can be just a trifle smaller than one half that of the circular disc in the center of the frame. The perspective makes this semi-circle agree with the lower half of the circle at the center of the frame. These two parts, the center of frame and the top of the sight-bar, must be more substantial that those used with the sight-finder of the lens pattern, because in looking against the light they would blur and be impractical if made too small. The slot for the sight-bar should be fastened on the outside of the same side of the camera that carries the two sockets for the struts on its inner side. It is made by cutting out two pieces of brass, say ⅞ x ¾ of an inch in size. Cut one piece in three parts and remove the



central strip, as shown at G. Place the plate, F, on top and drill the holes.

Centering

"In the matter of adjustment, to secure correct centering, a line from the top of the sight-bar to the center of the frame must be as nearly parallel as possible to a line from the center of the ground-glass to the center of the lens. Also, the central points of the frame and sight-bar must be perpendicularly over the line between the ground-glass and lens centers, and the several parts must be fashioned accordingly. Owing to the axis of these two parallel lines, there is a slightly different register for very short focal distances, say 6 or 7 feet. In practice, one must remember this and make a little allowance when needed.

Adjustment for Distance

"Everything ready, one has only to make the final adjustment upon the distance. Focus and locate on the ground-glass such objects as intercept the margins and corners and then place the eye in that position behind the camera that it is expected to maintain in the future. This latter is important. I find it best to place the camera against my cheek, bringing it opposite and but a short distance back of the sight-bar. This insures that the eye is always the same distance from the frame. One can then slide the frame to the point where it includes a view corresponding with that on the ground-glass. While it can be done, it is hardly necessary to mark all the distances usually indicated on the focusing-scale. However, one might start with the infinity point, and as that is the point where the frame is nearest the eye, it will be marked by bending the wire struts at the point where they meet the edge of the box when jammed home.

"There is no perceptible difference in the centering or in the amount of the view which the frame incloses, from this point of infinity down to about the 25-foot point. Consequently, if one has, in addition to infinity, a guide for the 15-foot point, and another which will show the amount included at the 6- or 7-foot point, he should get along very nicely. I have only marked mine down to 15. These short-distance points can be marked by filing a slight channel in the wire struts and tying a piece of black silk thread around at that point. In use, the struts are pulled out until their required markings are on a line with the edge of the box." If the reader can devise a method of hinging the finder to the lens front, as may be seen in the Icarette, this will be a decided advantage.

Various Lens Shades The very practical advantages which result from shading the lens during exposure are better understood and appreciated in Europe than in this country. But we are beginning to realize the usefulness of the lens-shade, and the following description and diagrams of various forms of lens-shades, given by James Thomson in "American Photography" will be welcome to many amateurs, as enabling them to make a lens-shade for their individual need since this convenience is not obtainable in the American market. I quote Mr. Thomson:

"Why the lens-shade is so little employed by photographers in this country is difficult to understand, for it should form part of the equipment of every camera-user of serious purpose. When the direct rays of the sun fall upon the camera front, the employment of some form of shade is necessary, especially when the lens is short-barrelled and used at full opening. Cutting off extraneous light results in negatives of better gradation and greater freedom from fog. Photographic books that warn against working into the sunlight are behind the times. Some of the most beautiful and satisfactory photographic results have followed the doing of that very thing, as many an advanced pictorialist can attest. Working against the late afternoon sun when shadows are long is responsible for some charming views; but in order to be successful, the lens must be shielded from the brilliant direct light by a shade, or by working in the shade of a tree.

"Some years ago when I began to take views along the Boston water-front, the need of some sort of a shade for the camera lens became apparent. My hand camera (along with plates and other impedimenta) I carry in a bag, and my desire was to rig up a shade which would take up small space and be readily applied. The wooden shade shown in Fig. 1 fills the bill and has the added advantage of enabling the worker when needs be to use a sky-shade in the manner shown in Fig. 2. Here is a shade answering the requirements of the 4 x 5 size of camera and easily produced at trifling expense.

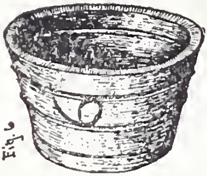


Fig. 6

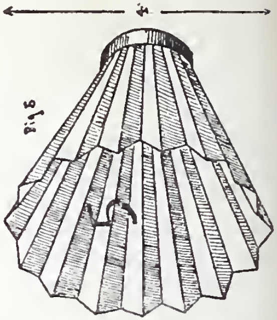


Fig. 5

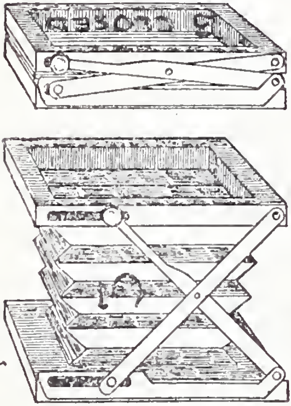


Fig. 3

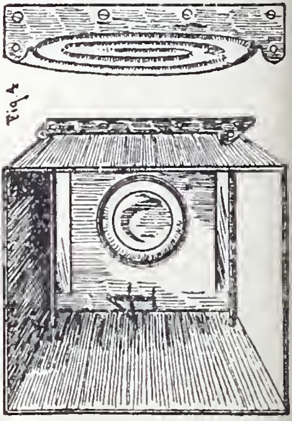
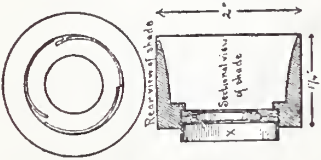


Fig. 4



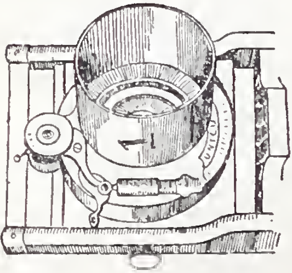


Fig. 1

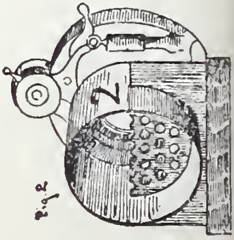


Fig. 2

"The lens-shade shown in Fig. 3 is suitable for any size of lens and of course it could be made without folds and still be serviceable. For telephoto work, two shades are used, one attached to the other. The small size (suitable for lenses up to 2 inches in diameter) when closed measures 3½ x 3 x ⅞ inches. The larger form, suitable for lenses up to 2¼ inches, is when closed 4⅓ x 3½ x ⅞ inches. The lens-shade shown in Fig. 4 one might very easily make for one's self. The hood, which is of leather, can be rolled up when not in use, but an alternative plan would be to fold it, which could be easily done. The outside measurements at hood-front are 3½ x 4 inches. In Fig. 5 we have a folding hood of pleated leather. This, too, is intended to be made of leather. The collapsible lens-hood shown in Fig. 6 can be easily fabricated from an aluminum collapsible drinking-cup purchaseable for a dime. Cut out the bottom to fit the lens, or it may be cut a little larger and lined along the sharp edge with cork or leather. Paint with black Japan, and you will have as good a lens-shade and as serviceable as the one here pictured in Fig. 6.

"I made the shade shown in Figs. 1 and 2 from a section of the wooden container in which gold paint comes. From any such hollow cylinder of suitable size a lens-shade can be fashioned for cameras up to the 4 x 5 size. In order that no part of the view should be cut off, the outer edge was filed away. For a long time I found the article perfectly serviceable with a piece of cork inside the smallest part of the cylinder to set it off from the mechanism of the shutter. In time, having accidentally broken the glass of a supplementary lens, I made a new shade and fitted to it the casing of this lens in the manner shown in the sectional view. The portion marked with an X is metal, the back part of it slit so that the affair is adjustable to larger or smaller lens-tubes. Such a shade as this is strong, of small bulk, and can be made at a cost of the price of the gold paint, the latter perhaps being usable for some other purpose.

"My first attempt at a similar shade was with a pasteboard tube reinforced with black passe-partout binding. It served well enough; but got crushed easily, hence the conclusion to resort to something that would bear hard usage.

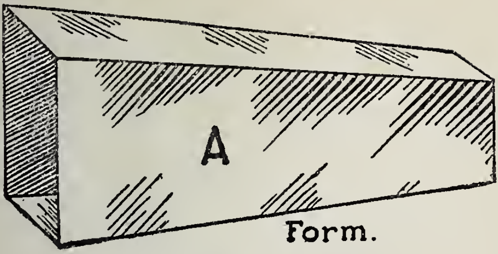
"The sky-shade is made from a part of a pressboard holder slide. Holes are punched in it in the manner indicated. Sawing half through the lens-shade provides just space enough to take the sky-shade. In a properly exposed out-of-doors view the sky is usually very much overtimed, the result being that clouds, sometimes so beautifully present to the vision, are totally eliminated through over-exposure. By using the sky-shade as shown in Fig. 2, abundance of time may be given the land or water without at the same time overtiming the sky."

Camera Bellows

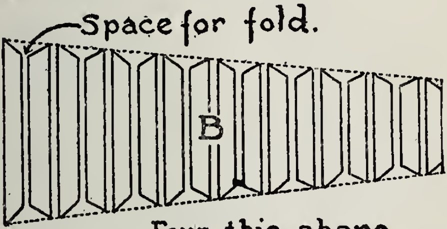
Making a bellows for a camera, folding enlarger, or lens-shade is not quite as simple in the doing as some of the other things described in these pages, but the task is not beyond the capacity of the average amateur who has a little more than average patience. The following description, by Samuel H. Avery in "American Photography" tells how the work is done. The instructions, of course, apply equally to the making of a square or tapering bellows, the only change needed being in the shape of the form used as a working base.

"The materials for making a bellows are not many: they are cardboard, black goods, glue and bookbinders' leather or rubber cloth. First make a form, Fig. A, which can be either square or tapering, the size of the bellows when finished. It can be made of cardboard for small bellows, and wood for the larger ones. Next cut out four cardboards shaped as Fig. B, which serve as the ribs or skeleton on which the cloth and leather are glued. An easy way to make these ribs is to tack a piece of cardboard to a drawing-board, use a T square and lay them all out at the same time. In this way they will all be the same size and proportion for all four sides. The glue should be mixed with a little glycerin to keep it from drying out and cracking.

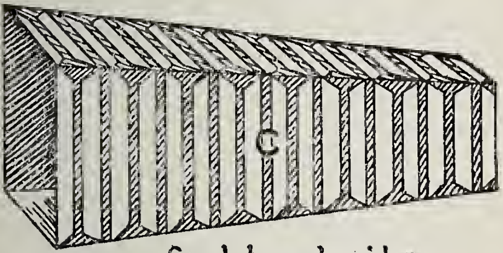
"We are now ready to put the bellows together. First lay the black goods around the form and cut it in one piece to the proper size and shape, then fasten it to the form, either by gluing or sewing the edges in the



Form.



Four this shape.



Card board ribs pasted on form.

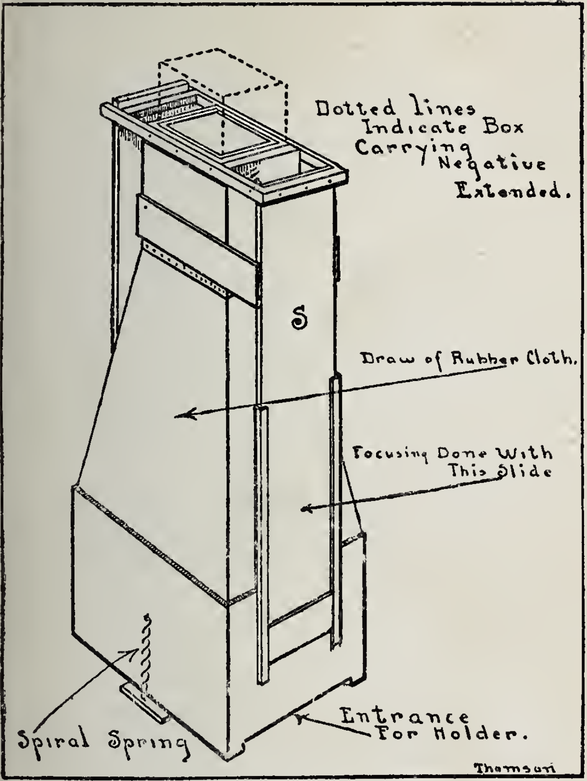
middle of the bottom section. After placing the goods on the form the next step is to glue the cardboard ribs in place as in Fig. C. Enough space must be left between the cardboard ribs to allow for the folding of the cloth and leather.

"The last step is to place the bookbinders' leather over the form, cut it the right size and shape, then glue it tight to the ribs. After the glue is set, the bellows can be slipped from the form; fold to its proper shape and it is ready to be placed on the camera."

A Fixed-Focus Enlarger

A simple, fixed-focus enlarger, which has been received with much favor, is that designed by J. B. Thomson for his monograph in The Photo-Miniature No. 123. This enlarger is suitable for enlarging from a window, or, in lieu of that, placing in a vertical position out-of-doors. Anyone who can use tools can make such a camera in some sort of fashion, and, if a nicer job is desired, a carpenter could furnish the necessary woodwork all planed and cut to sizes. When made to take 16 x 20-inch enlargements, the better plan is to have it arranged horizontally upon a table. When at an angle upon a table, the negative pointed to the sky, there is then obtained the full benefit of the light, because in this case there is needed no diffusing screen, the use of the latter doubling the exposure.

The length is, of course, dependent on the focal capacity of the lens employed, while the dimensions of the lower box are governed by the size of enlarged picture likely to be required. The lens used is one from a folding hand camera, and is 5½ inches in focus. The largest negative that can be enlarged from is 4 x 5. Fully extended, the length is 28 inches, the outside measurements of the larger box (which forms the base) being 14 x 11½ inches, while the depth is 10 inches. The outside upper box is 6 x 7 inches, and 9 inches deep. In this upper box are two smaller boxes which telescope into it, dividing the available space between them, the one carrying the lens, the other the negative. The slide *S* controls the focus, and once the image has been focused sharply for the regular sizes of enlargement, marks may be made upon the woodwork, so that there is afterward no need to repeat the operation. There is no slide on the far-off side, the board there shown being simply screwed to the base, and left free at the top, thus forming an excellent bed upon which to slide the upper section of the instrument. To hold the negative, a 5 x 7-inch kit may be cut down to the dimensions of the inner box, which is 5½ x 6 inches, the opening for


Dotted lines Indicate Box Carrying Negative Extended.
S
Draw of Rubber Cloth.
Focusing Done With This Slide
Spiral Spring
Entrance For Holder.
Thomson

Thomson's Enlarger No. 1

the negative being 4¾ x 3¾ inches, with a rebate or sinkage the thickness of the glass. The draw—which may be secured at the corners—is made of good quality black rubber cloth, or any similar semi-stiff opaque material which will give good wearing service.

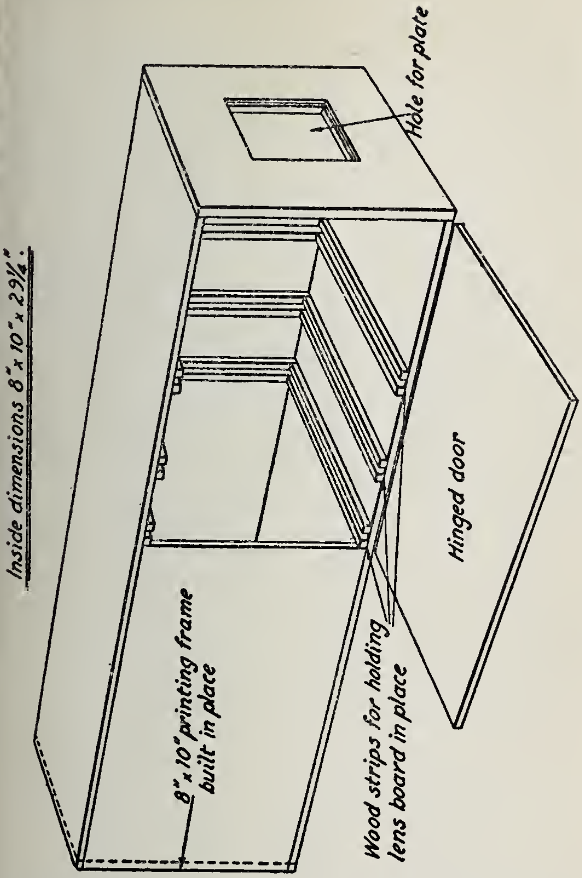
A Three-focus Enlarger The simple, fixed-focus enlargers sold in the stores give, as the reader knows, enlargements of one fixed size from the small negative for which the particular enlarger purchased is adapted. For example: the No. 4 Brownie Enlarger gives an 8 x 10 enlargement from a 4 x 5- or 3¼ x 5½-inch negative.

In a recent issue of "The Camera," Francis M. Weston, Jr., tells how he devised a three-focus enlarging box which gives him enlargements of two-times, three-times, or six-times at will. From his description and diagram of the enlarging-box which follows, the reader can readily lay out and construct an enlarger of like usefulness, suited to the regular size of plate or film he uses. Mr. Weston says: "I wanted to build a two-times enlarging-box in order to enlarge my regular size of plate—4 x 5 to 8 x 10. That was easy enough, but I also had several very small films which had to go up to 5 x 7. I was thus confronted with the question as to whether it would be better to be satisfied with a two-times enlargement of my small films, or whether I should go to the trouble of building another box for them.

"At first, I had the idea of building a longer box than I needed, and providing extra slots for my plate- and paper-holders. Finally it occurred to me to find what focus my lens had with a portrait attachment on it, and therein lay the solution of all my troubles. I found the length of focus to be such that I could just get a three-times enlargement in the space of my two-times box.

"As other designers may prefer to work out the details of construction to suit themselves, I shall describe only the main points of my work. The first essential is to figure the length of box to make the desired enlargement with your regular camera lens. My lens is a 6½-inch R. R., and I wanted a two-times enlargement, so the total distance from plate to paper is 29¼ inches, with the center of the lens 9¾ inches from the plate. Then I determined the position of the lens with portrait attachment, to give sharp focus in a length of 29¼ inches. As an added advantage, I also used an auxiliary copying-lens on my rectilinear, and found that in the length of my box, I could get a six-times enlargement of a small part of my film.

"In building the box, I used boards about one-


Hole for plate
Inside dimensions 8" x 10" x 29¼".
Hinged door
8" x 10" printing frame built in place
Wood strips for holding lens board in place

quarter inch thick, made three sides plain, fitted an 8 x 10 printing-frame on one end and a plate-carrier on the other, and mounted my lens on a removable board. Then carefully measuring off my calculated distances, I nailed on narrow strips to hold my lens-board in the desired positions.

"The fourth side of the box, from the lowest lens-slot to the printing-frame, I closed light-tight by nailing on a board (see diagram). The space above this was closed by a hinged door. A coat of black paint on the inside, a strip of felt around the door, and my box was complete. By simply slipping out the lens-board (not shown in the diagram), inserting it in another slot, and closing the door, I convert my two-times enlarger into a three-times or a six-times.

"Buy a portrait attachment and a copying-lens to fit your camera, and experiment a little. When locating the slots in the box, for the different combinations of lenses, work carefully and accurately; but do not feel disheartened at any slight, unavoidable variation from the true position, for by using a small stop no effect will be noticeable in the finished enlargement."

The vital features of Mr. Weston's enlarger are the length of the box and the placing of the slots for the lens-board at the correct positions for the degrees of enlargement desired. The length of the box will be determined by the sum of the two distances—from sensitive paper and negative respectively to the center of the lens for the largest degree of enlargement desired, and these distances will vary (and with them the position of the lens-board) according to the focal length of the lens used. The data required can be seen at a glance in the following table of distances for lenses of from 3-inches to 7-inches focal length.

Tables giving these varying distances for lenses of different focal lengths, and for any desired degree of enlargement, may be found in "The British Journal of Photography Almanac," "The American Annual of Photography," and in many elementary textbooks, together with a table showing the relative exposures required when enlarging to any given degree. There is a useful page on this detail in The Photo-Miniature, No. 144: Enlarging on Development and Bromide Papers.

FOCUS OF LENS	Times of Enlargement		
	2	3	6
3 inches	9 4½	12 4	21 3½
3½ inches	10½ 5¼	14 4⅔	24½ $4\frac{1}{12}$
4 inches	12 6	16 5⅓	28 4⅔
4½ inches	13½ 6¾	18 6	31½ 5¼
5 inches	15 7½	20 6⅔	35 5⅚
5½ inches	16½ 8¼	22 7⅓	38½ $6\frac{5}{12}$
6 inches	18 9	24 8	42 7
7 inches	21 10½	28 9⅓	49 8⅙

In the use of this table the larger figure represents the distance required between the sensitive paper and the center of the lens, and the smaller figure represents the distance required between the negative and the center of the lens.

An Enlarging Room

If the reader is an enthusiast as to pocket cameras, he will find it necessary to provide himself with equipment and means for making enlargements with a minimum expenditure of time and trouble. A fixed-focus enlarger or the three-focus enlarging box, as illustrated on another page, may serve this purpose, but where one has much enlarging to do there is practical wisdom in providing an enlarging room. This need not be a room separated off and solely used for enlarging, but merely a convenient room with a portable equipment for use when needed. A room with a single window facing north is best adapted to the purpose. The arrangement of such a room, the screening of the window and the provision of the necessary equipment are detailed in what follows, taken from James Thomson's monograph on "Enlarging on Gaslight Papers" in The Photo-Miniature No. 123, now out of print and unobtainable. In my own practice, some years ago, I used an attic for this purpose, with a small window facing the sky, and the base supporting the camera and easel placed on a stout board running from the floor to the base of the window. With such an arrangement no reflector outside of the window is needed. Care should be taken to secure perfect parallelism between the window, negative and easel.

With a room arranged as here suggested, it is possible to make enlargements, notwithstanding the outfit be one most rudimentary. For example, an empty box may be fastened to the window-sill, the camera (lens inward) placed upon it, and a table upon which is an empty box placed on end, bottom to the lens, set some little distance away. The camera, probably of the short-focus variety, must have an extension attached at the rear, so that the distance between lens and negative is increased. A pasteboard box may be made to answer, a black card forming the back, in which is an opening made to receive the negative, which can be best held in place with gummed-paper strips. Outside light other than that which comes through the lens being excluded, a sharply focused image is thrown upon a white paper sheet pinned to the box bottom, and thus are we ready for the exposure. The light upon the screen will likely show unevenness, the upper section being darker than the lower. There are two methods whereby this difficulty may be overcome: We may place a white card reflector outside of the window, to throw the light upward, or we can with a card shade the lightest portion of the image during the exposure.

The blocked-window arrangement shown in Fig 1 is such as I have been using for years in bromide enlarging. Changes might be in order, to conform with individual requirement, but it is most convenient to

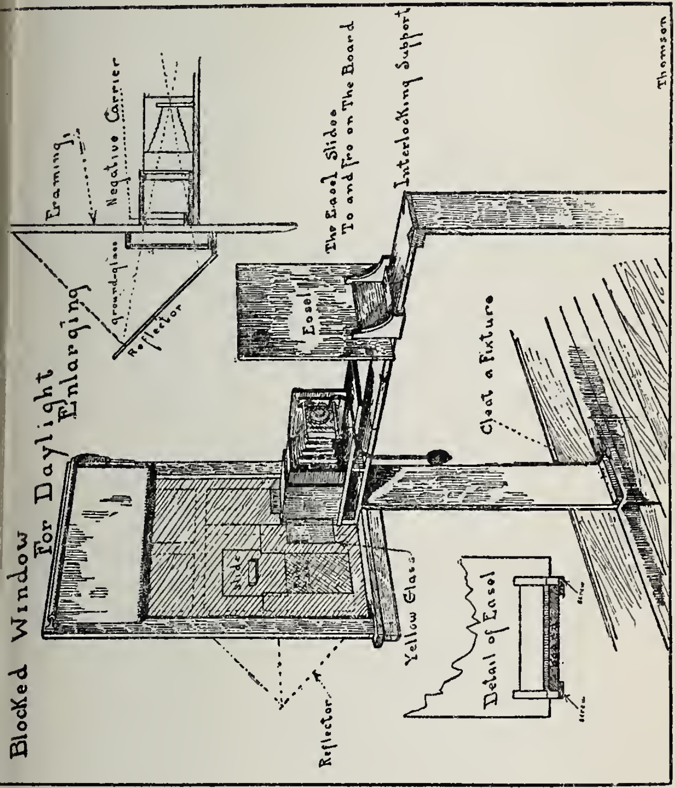


FIG. 1. Showing the window equipment for enlarging in a room

stand on the side of the ruby glass, and there have full control of operations even in a totally dark room.

As a rule, such an outfit is placed on a level at right angles with the wall of the room. To point the negative upward, with consequent depression of the other end of the board, is a much better plan, as the illumination is better and more evenly distributed. The lower sash of the window should be raised, as the green quality of common window-glass is most obstructive. It probably cuts off 50 per cent of actinic power. The whole equipment costs but a trifle beyond the labor involved. A 4 x 5 hand camera fitted with a good quality R. R. lens of 6½-inch focal capacity is suitable. This admits of enlargements being made with *f*/8, though more often *f*/16 is used.

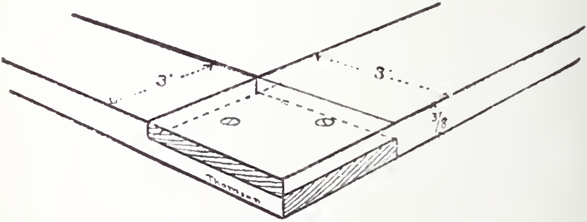


FIG. 2

The Window-Frame

There is but a single window in the room, and for this a light frame was made. Strips of whitewood (poplar in some parts) 3 inches wide and ⅜ inch thick were used, the corners being jointed in the manner shown in Fig. 2. The frame, when made, was covered with black carbon mounting-board, leaving openings for camera extension and ruby glass. The cross rails serve a double purpose. They stiffen the frame and furnish a substantial outline for the extension-box of the camera, which is screwed to the frame through the inside of the box, and then the edges are chamfered so as not to obstruct light. A slit in the top of the box receives the negative carrier, which is made of a 5 x 7 kit with a 4 x 5 opening. To the left of the camera a cardboard slide, moving up or down, covers the ruby glass when such is required—as in the case of plates. On this slide a piece of wood is screwed, serving as a handle and easily located in the dark.

The equipment is removable. When not in use, it is kept in an adjoining closet. It takes but five minutes to set it up and less to remove it. The lower sash of the window is raised, the framework then being pressed into the space reserved for it. Weather-strips serve to keep out light around the edges. The frame is much easier handled when made in two parts coincident with the sashes of the window. In that case, the upper section is first put in place, to be quickly followed by the lower. A strip of wood nailed to the lower frame over the joining serves to keep out light, and, when all is held in place with push-pins, helps to hold all secure. The depth in the wooden extension-box from the back of the camera to the negative is 6½ inches. All woodwork outside of the negative carrier should be white-painted; all inside of same, stained black. All sharp edges outside of the negative kit liable to obstruct light should be beveled before painting.

The Easel

A board conforming to the size of the largest enlargement likely to be required should be provided. A drawing-board answers best because made of pine and flush-cleated. The long board upon which the easel slides may well be 10 inches wide, 5 or 6 feet long, and ⅞ of an inch thick. It should be accurately planed top, bottom and sides, and should be of even width and thickness, to the end, that the easel may slide back and forth without hitch or hindrance. While not essential, it is a good plan to cover the face of the easel with cork linoleum, into which pins (which should be of the toilet, glass-headed variety) will stick readily. Some sort of catch should be attached to the easel to hold it firm once it is placed.

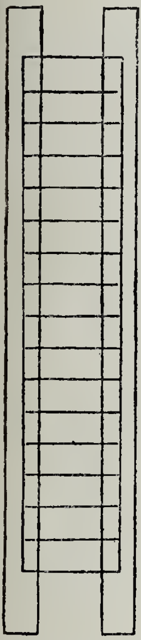
A Bolting-Silk Frame

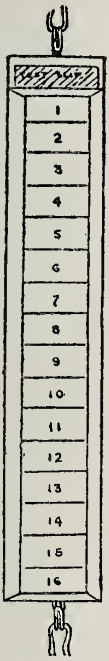
It is well known that a thin or harsh, contrasty negative can be made to give a pleasing, softly defined enlargement by interposing a piece of silk bolting cloth or fine chiffon between the lens and the sensitive paper during the exposure of the enlargement. But these delicate fabrics are expensive in use and difficult to handle because of their extreme fragility. Some workers stretch the fabric over the front of the lens, fastening it to the lens-tube by means of a rubber band. Others use a piece of fabric as large as the enlargement desired, stretched on a wooden frame and placed at varying distances from the sensitive paper, according to the degree of diffusion required in the enlarged picture. A simpler and more satisfactory plan, which permits one to interpose the fabric during either the whole or only a portion of the exposure, as may be desirable, is to mount the fabric on a small frame which may be held in the hand during use. To make such a frame get two pieces of stout strawboard or bookbinders' board, say 12 x 15 inches and a piece of bolting silk or chiffon 11 x 14 inches. From the center of each piece of board cut a rectangular opening 9 x 12 inches. Thoroughly gum one side of one piece of board and carefully stretch the chiffon or silk across the opening. Now gum one side of board No. 2 and press this down into close contact with the gummed side of board No. 1. Place the combination under a weight until thoroughly dry, after which bind the edges with gummed tape such as is used in passe-partout framing, and the frame is ready for use. The degree of diffusion in the enlargement depends on the distance at which the fabric screen is held away from the lens. The increase in the exposure required when such a fabric screen is used can only be learned by trial and experiment, but will always be double the exposure needed without the interposition of the screen.

A Simple Actinometer

In platinum, carbon and gum printing, the use of a simple actinometer, as a guide to the progress of printing, is essential. The construction of such an actinometer is here described by James E. Callaway. It has the merit of compactness, and in shape is adapted for use fixed to the side of the printing-frame.

First draw on a piece of board a rectangle ¾ inch wide and 4 inches long. Mark this off into ¼-inch spaces, cut a number of strips of tissue paper ¾ inch wide and of any convenient length, and proceed to lay them on this drawing so that each rests on the next lower mark than the preceding strip. When you have laid down enough to cover all the marks, place a moistened ¼-inch strip of passe-partout binding to cover each edge of the pile of strips, overlapping ⅛ inch. This will hold all the strips to it, when they may be fastened completely by folding the edges of the binding over the back. Cut off surplus tissue and binding at ends, and you have the scale of the actinometer, in which you have tissue ranging from one thickness to sixteen. Mark on the back strip (writing the figures backward), numbers from 1 to 16. This brings the figures nearer to the sensitive paper which is to lie beneath, and makes them more readable than if written on the front.





Cut a 4¼-inch piece of pasteboard thick enough to make a good backing, and fasten the scale down to it by binding the edges as in passe-partout work, fastening all edges but the top, where the surplus backing is to be left. Double a piece of binding over the tissue at the top edge of scale to make a neat finish, and another over the ¼-inch overlap of the back.

Tie two hooks, of the dressmaker's variety, to a piece of string just as long as the actinometer, and paste this down to the back of the instrument, so the hooks project to the front. The string is to take the strain off the card. When you wish to attach the actinometer to the printing-frame, lay it on an edge of the frame, loop a rubber band in one hook, carry it around the back of the frame, and attach it to the other hook. To use the instrument, insert a slip of solio paper under the scale, and time your printing by the numbers as they become readable. In replacing the slip, be sure to push it fully in. When you have made a good print, note the reading for that negative, and use it thereafter whenever you need a similar print. If you have a spoiled film, you can improve the actinometer by covering the front with a strip of clear celluloid, which will make it easier to keep clean.

Make three or four actinometers of the above pattern at one time, as the labor is practically nothing, and you will be supplied with one for each frame in use.

An Improved Tripod Head

Those who have fumbled and used picturesque language in the attempt to get the tripod screw to enter the hole provided for it in the camera will appreciate the improved tripod head here described and illustrated by Dr. Joseph Hicks. It is a big improvement over the common arrangement, and its making involves little or no trouble at all. I quote Dr. Hicks:

At one end of the hole in the tripod top, I bored a hole a little larger than the shoulder on the tripod screw. The two holes were connected by cutting away the wood between them, and at the opposite side of the larger hole the wood was cut away, so as to make a hole as in Fig. 1 large enough for the head of the tripod screw to pass through easily. A small brass bolt, three quarters of an inch long with a nut with a milled edge, was bought (Fig. 2), and a flat piece of brass obtained, one eighth of an inch thick, one inch wide, and two inches long. In one end a hole was drilled the size of the bolt, and in the other end a slit filed of the same width as the diameter of the tripod screw, one-half inch from the end of the strip, rounding off the corners of the opening slightly, as in Fig. 3.

The tripod screw being placed in position with the brass strip under the shoulder, a bradawl was passed through the hole in the other end of the strip, clear through the tripod head, so that the point of the bradawl showed through on the other side. Next, the cloth on the tripod head was cut with a knife round three sides of a square, in the center of which was the point of the bradawl, the square being somewhat larger than the square head of the bolt. The cloth was lifted up from the wood and enough cut out so that the square head of the bolt should be flush with the top of the tripod head. In the center of this square a hole was made large enough to pass the bolt through, and then the cloth was glued down again back into the place it originally occupied. The brass strip was placed in position and the nut screwed to the bolt. Fig. 4.

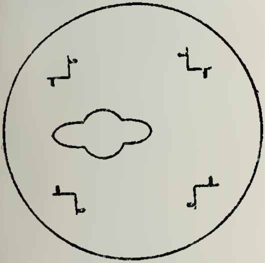


FIG.1

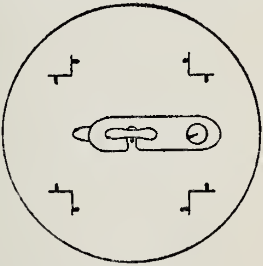


FIG 4

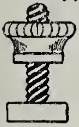


FIG 2

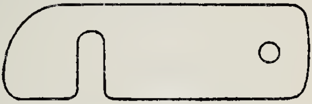


FIG 3

In making use of this arrangement, the tripod screw is first attached to the camera, then passed through the hole in the tripod top, the brass strip is hooked under the shoulder of the screw, the camera screwed down into place, and then the nut tightened on the bolt and all is secure. In practice all this is done quickly.

When ready to take the camera off, we proceed as we have been in the habit of doing, leaving the screw in the top of the tripod; the nut will hold the brass strip in place, there will be no danger of the tripod screw being lost, and it can easily be removed from the head when desired.

It is probable that a common, round-head screw would answer the purpose as well as the nut and bolt, but the latter costs only a few cents and, being adjustable, will give better satisfaction in the end.

A Cement Sink

The advantages of a cement sink for photographic uses are cleanliness, cheapness, and absolute security against leakage. By following the method described below, due to a veteran photographer, Mr. A. B. Stebbins, one can make one that will be a luxury compared with the ordinary wooden sink, and at a trifling cost in labor and cash.

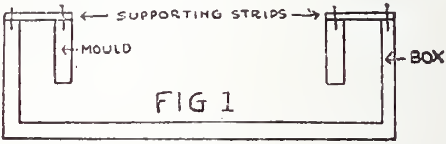


FIG 1

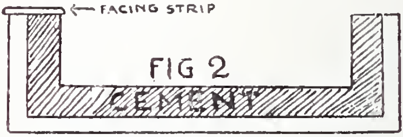


FIG 2

The most important point is a good foundation—that is, a solid box so supported that there will be no settling or spring. The box should be made four inches wider and two inches deeper than the inside dimensions of the sink, using good one-inch timber. It should be well nailed together, put in the place in which it is to be used, and have the drain pipe well fitted at this stage. I recommend that the cement bottom be two inches thick, so the pipe must be run through the box one and three quarters of an inch, so as to let the cement set around it. This will hold it tighter than if it were screwed in. It is fixed in the right place and stopped with a cork. It will be a good plan to put a union just below the sink, if one is at all likely to want to disconnect it at any time.

The cross section (Fig. 1) shows the box ready to be filled. It will be noticed that all the pattern or mold needed is a wooden frame four inches less in width, and two inches less in height (outside measurement), than the box. It is supported even with the top of the box by narrow strips tacked on so as to hold it in place equidistant from the sides and two inches from the bottom; these strips are indicated in Fig 2.

The next thing is to get a workman to put in the cement. He should be told to handle it drier than he would for a cement path, or it may drip through, since there is no need of any tight joints in the box. It should be allowed to set from two to three hours, and then the mold may be pulled away, and it is ready for troweling. It is then left to set overnight, and it will be ready for use in the morning.

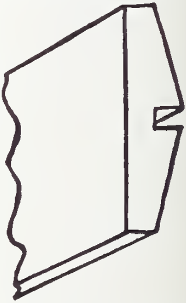
The best Portland cement and good clean sand should be used. One-half barrel of cement and three bushels of sand will make a sink 3 x 7 feet inside. I use three parts of sand and two parts of cement, but, if one has any confidence in his mason, these points may be left to him to decide. I have put two such sinks in my workrooms; have got things ready, had the man fill the molds between 5 and 6 P.M.; they were ready to trowel between 9 and 10 P.M., and were in use the next morning.

To finish the sink, a facing of planed wood may be put round the top (indicated in Fig. 2), and allowed to project one fourth of an inch inside (this is to protect the edges). I also use a planed piece of wood in the front of the box. A coat of paint gives it the finishing touch. If it is thought necessary, the sides, corners, and bottom of the sink can be reinforced by putting big nails or spikes in the cement. These should be completely buried, and then they will not rust. Heavy wires can be run in through the bottom; but if one has a solid box, good cement, and clean sand, these are not essential.

None of the chemicals used in ordinary work will affect such a sink except strong acids. It does not absorb and retain moisture or odors; developers do not stain it, and it can be scrubbed out as one would scrub a stone sink. It gets harder as the years go by.

Double Trays Trays are a continual expense to the amateur as well as the professional, especially in the larger sizes as needed for washing and toning prints, salting and sensitizing papers, enlarging and the like. The most economical, as well as the most satisfactory, tray for work of this kind is the double tray with a thick glass bottom. Such a tray can readily be made by any carpenter, or even at home, at a slight expense. The following instructions for making double trays are taken from "The Camera."

The lasting qualities of this kind of tray are unquestioned, except by those who have never made or used one of them. The glass bottom never comes in contact with either the bottom or the sides of the sink or bench or work-table, as the case may be, the edges of the tray bear the brunt of this wear. Another use to which this class of tray can be put is the toning of large prints upon one side, while the other is kept particularly clean for the pasting of such prints when mounted. In fact, a sheet of glass mounted in this manner becomes well protected, even if used for pasting purposes only. At the same time, should any dirt be present, it can readily be seen and easily removed, which is more than can be done with any ordinary tray.



The sketch shown in Fig. 1 shows the wooden frame in section, with the groove to receive the glass plate, which, with large trays, should be ¼ of an inch thick, even $\frac{5}{16}$ of an inch, but in smaller trays sheet glass ⅛ of an inch thick will do. Where the groove is made in the wooden strips shown in Fig. 1, it must be made just a little larger than the sheet-glass to be inserted. This is to allow for the cement to hold the glass firmly in position and making the joint waterproof at the same time.

The kind of wood used by the writer for making the body of this glass tray was white pine, well seasoned, the corners being cut to a plain miter for a butt joint, and the cement used for holding the glass plate in position as well as being waterproof, is made up of a mixture of common whiting and shellac varnish of the consistency of very soft putty. As soon as the wood has been cut and the miter fitted accurately, four angle or corner pieces of wood must be made to grip the corners of the tray, around which a double width of sash-cord has been wound to draw the miter tight, upon the twisting of a piece of wood about a foot long and an inch square.

Putting the Tray Together

The miter joints must be coated with a thick shellac varnish twice to form the joints. The grooves must be brushed through with shellac varnish and partly filled with the whiting and shellac mixture. The sheet of glass must then be placed in position in the groove. This will require the assistance of another person. Then place the corner pieces on. Now wrap the sash-line round twice, place in the stick and put on the twisting force. The whole frame will draw up perfectly square. The shellac mixture will squeeze out and the shellaced joints will draw up quite square. When considerable strain has been applied, the corners must be wiped clean and the shellac cement smoothed all around on the inside of the frame, leaving a smooth wiped edge all around upon the glass plate on *both* sides.

The tray is now securely held together by means of three thin 2-inch screws at each corner, the holes for these being carefully pierced and countersunk so that each screw will go home without splitting the wood. The screws should be inserted so as to lie across the miter at each corner, securely holding the sides and the corners of the tray. Now allow the tray to remain undisturbed for twenty-four hours, then the sash-line can be released, and the cement can be cleaned and trimmed true by the use of a sharp 1-inch carpenter's chisel. It will be found that the cement will be cut like a piece of soft stone. As soon as the joints have been well cleaned the screwheads should be covered with cement, filling up the countersink of the imbedded screwheads. Then as soon as the cement becomes set it can be rubbed down with sandpaper, making the frame quite smooth. The inside can now be coated with two coatings of shellac varnish for a finish and the outside painted with a mixture of shellac varnish mixed with a small quantity of crocus. This will give a fine waterproof finish of a fine chocolate-color; of course, the whole of the glass bottom is left clean, being shellac varnished at the joints only. This class of tray is capable of a great deal of rough every-day handling without fear of breaking or ripping a piece out of the side or cracking off the enamel. The writer used a set of four of these trays in his photographic business for seven years, and not a tray became broken. They were used for every class of photographic work, except where hot water had to be used, as in carbon-print developing. As for pasting up large prints when placed upon another, no other plan was equal to the use of this glass-bottom tray for cleanliness and facility of application. Trays made in 10 x 12 size or 15 x 17 will be found exceptionally useful and will outlast any papier mache or composition tray ever made.

An Electric Printing-Box

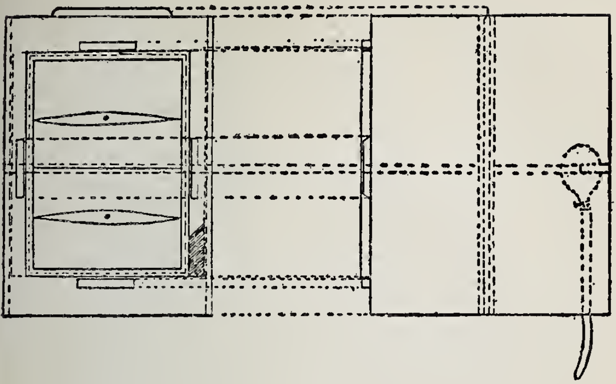
Even the most skilful of amateurs are prone to spoil many of their prints if they follow the hit-or-miss method of holding their printing-frames up to the light and guessing at the distance and the exposure required.

Many printing-machines have been put on the market, the majority being for professional use and too expensive for the average amateur making but a few dozen prints at infrequent intervals.

The following directions, taken from Abel's "Amateur Weekly," will enable anyone possessing but a small amount of ingenuity to construct a most satisfactory electric printing-box at a cost of but a few cents.

This box enables the operator to make prints more rapidly, economically, and easily, for he can remain seated during the entire operation. The labor and the paper that will be saved in one evening's work will alone more than repay the effort entailed in its construction.

Although these measurements may be slightly varied if necessity demands, secure if possible, a box of ⅜- or ½-inch pine, approximately 10 inches in length, 8



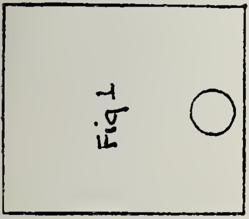


Fig 1

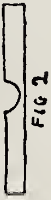


FIG 2

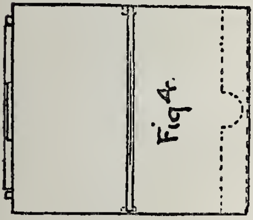


Fig 4.

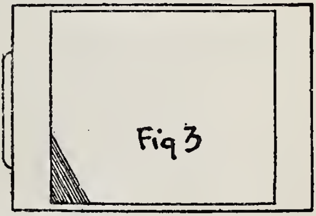


Fig 3

inches in height, and 7 inches in width. Your grocer will give you a baking-powder box that will answer the purpose.

In one end, near the bottom, bore a hole 1½ inches in diameter (Fig. 1), through which the electric cable will pass. Inside, in the center, nail crosswise of the box an upright strip, cut like Fig. 2. This will serve to hold the bulb in position as it rests lengthwise on the bottom of the box.

Next comes the slide (Fig. 3). This must be cut from a tough piece of ¼-inch board, cut just a trifle narrower than the inside dimensions of the box, and about 2 inches longer, with one end rounded. Cut out the center, leaving a frame over which red cloth must be glued.

In the end of the box opposite the cable-hole, cut a slit (Fig. 4) 4 inches from the bottom and large enough to accommodate the slide (Fig. 3). In line with this on the inside, nail two narrow strips on each of the other three sides of the box, far enough apart so the slide will work freely back and forth.

The top of the box should be closed up, except for an opening about 5 x 7 inches, or larger, over which a 5 x 7 printing-frame is to be placed and held in position by a small strip.

After giving the inside two coats of white paint, and installing a 25-watt Mazda bulb and cable, the box is ready for business.

The light shining through the red cloth of the slide enables one to adjust masks and paper in printing-frame without the possibility of fogging.

When ready, simply pull out the slide, expose, and push back. Draw the slide out to its end but not entirely out of the box.

A test strip of paper will soon enable one to gauge with accuracy the number of seconds necessary for exposure.

If one does not possess a regular clock for timing exposures, a musician's metronome can be used, the exposure being timed by counting its ticks.

A Lantern-Slide-Making Camera

The making of an efficient fixed-focus camera for producing lantern-slides by reduction is here described by Harrison Wall, as published in "Photography" a year or two ago.

Lantern-slides which are made by reduction in the camera seem to be finer in definition than those made by contact, although the difference may not come to much on the sheet. They have the great advantage for users of quarter-plate or larger cameras that the whole of the picture, as originally arranged on the ground-glass, can be included in the slide.

A great deal of time and trouble can be saved by using a lantern-slide camera, working to fixed focus, so that whatever may be the size used, that size is reduced so as to go comfortably on a lantern-plate. To do this, the longer dimension of the negative must be reduced to about 3 inches. When the picture itself occupies only a part of the original negative, it is always possible to mask what we do not want to get on the slide. This is simpler than using an adjustable lantern-slide camera with which, of course, we can get, occupying the whole of the lantern-plate available, just that part of each negative which forms the picture.

The writer has used a simple home-made lantern-slide camera for some years and as it is quite satisfactory and calls for no great skill in its construction, a description of the method by which a similar instrument can be made is given herewith.

The basis of all measurements will be the lens. Almost any lens may be used, but the best lens, other than an anastigmat, is a quarter-plate rapid rectilinear, or failing that, an achromatic meniscus, as these allow the use of a large stop in the camera, which is often a great advantage.

Many photographers have by them such a lens, or one can often be picked up very cheaply indeed. When obtained it should be mounted on a board some 3¾ x 4¾ inches, and measured. There is no need to find the focal-length of the lens, as all we want to know is the distance from the object to the lens-board, and from the board to the focusing-screen when the lens is reducing to the requisite extent. A simple way of doing this is to cut a slot about ⅛ of an inch wide in a piece of card, the slot being as long as the long way of the plate used for negative-making. Over the slot may be pasted a piece of very thin tissue paper, and then a light being put behind it, an image of this slot is projected with the lens on to a piece of white card. The card and lens are adjusted until the image is perfectly sharp and 3 inches long, and then the distance of the two cards apart and the position which the lens occupies between them are measured.

A cardboard box has now to be made in length equal to the separation of the cards, with the lens on its board fixed in the box in the position indicated by the experiment. It will be found helpful if eight strips of wood, say ¼ x ¼ inch, are cut. Four of these occupy the internal angles of the box on one side of the lens and the others on the other, running lengthwise. Each four should be cut to exactly identical lengths, so that they not only stiffen the box—they are glued in—but also make it very easy to secure parallelism between the end pieces and the lens-board. This parellelism is very important.

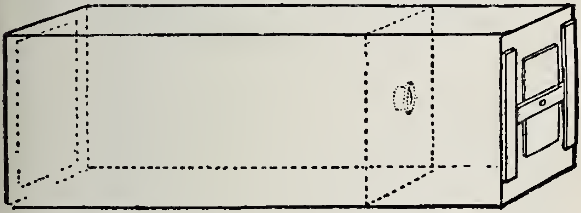
The end pieces are merely frames or boards in one of which is cut an opening ½ inch smaller all round than the negative, and in the other 3 x 3 inch. Round the opening is fixed a fillet of wood (my own is of card) to keep the negative or plate in place; but before doing this it is best to test the length very carefully, to make quite sure that the negative and plate are exactly at the right distance apart, to give a critically sharp image. If not, one or more thicknesses of card may be glued on to the end requiring it, so as to bring about the desired correction.

For making this test a fogged lantern-plate with a few scratches on its film should be used on the side where the lantern-plate is to come, and a piece of ground-glass on the negative end. The film side of the lantern-plate and the ground side of the glass should be turned toward the lens. It is easier to focus an object on a piece of ground-glass at the negative end than *vice versa*. Of course, when the lens is sharply focusing an object at one end on the ground-glass, at the other it is equally in position to focus an object where the ground-glass is on a screen at the opposite end. With a rapid rectilinear or a single lens (corrected for photography), *f*/16 should be the smallest stop necessary.

There is no need to alter the stop, so that the lens need not be accessible. In my own case, there is a door in the cardboard box just over it, as I thought I might want to get at the lens, but so far it has served no useful purpose.

The interior of the box should be given a coating of dead black. If black glazed lining or similar fabric is glued and put down over the outside, it will be found that there is a great gain in rigidity and strength.

The method of fastening the lantern-plate into position is a very simple one, being that used in a child's drawing-slate. A board covered with a piece of carpet-felt is put down on the plate, and at the back of the board is a cross-piece turning on a pin, so that its ends can be brought under two catches provided for the purpose. The negative is held in position by two or more turn-buttons; and a loose cardboard lid is made to go over that end of the box, and completes the arrangement as seen in the accompanying diagram.



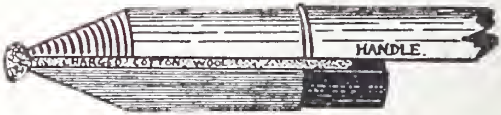
Such an apparatus is used by inserting the negative in position and then taking it into the darkroom, putting a lantern-plate in the other end, and covering the negative end with its lid. It is then set up on end, negative uppermost, out-of-doors, or placed so that there is a clear exposure of sky beyond the negative, and the exposure is made by removing the lid and replacing it.

The actual time of exposure will be found to vary from 8 to 10 seconds to as many minutes, according to the plate, stop, negative, degree of reduction, etc., but as the same stop and the same degree of reduction are kept to throughout, and the same make of lantern-plate used, the only variable factors become the strength of the light and the density of the negative being reduced.

By using an exposure meter to measure the intensity of the light, it becomes a very simple thing to estimate the exposure, since the density of the negative is then the only thing for which we have not a definite figure.

How to Make a Nigrostyle

This little instrument, which is so easy to make and easier to use, is, next to the pencil, probably the most useful tool for a retoucher to possess. And yet photographers are slow to adopt it, probably through ignorance of its actual value. With it we can lay on a tint of lead on a negative quite rapidly, work up the lights and halftones of draperies and hair; fill up shadows that print too deeply, such as are usually kept back by yellow putty or color on the back of the negatives; and work cloud effects with a quickness that is surprising. The latter application of the tool is especially useful in portraiture, for with an ordinary cloud background we reproduce the same effects every time we use it, and often the stereotyped clouding appears where it is least desirable; while with the nigrostyle we can regulate the form, pitch and density to our liking. In the better-equipped establishments the air-brush is generally used for this class of work on negatives, but the nigrostyle accomplishes the work quicker, and much more effectually, leaving absolutely no grain or clue to work having been done—that is, if it has been done well. In fact, for negative work it is an air-brush and stump (or "stomp") rolled into one.



Mr. Arthur Whiting, who wrote for The Photo-Miniature series the very useful handbook on after-work on negatives, published in No. 116, now out of print, gives the following description of his invention of the Nigrostyle, which will enable the reader to make he instrument for himself without any great difficulty. I quote from "The British Journal of Photography:" Take a paper stump about half or five-eights of an nch in diameter, cut it in half, and with a narrow-bladed knife scoop out the middle, commencing from the part you have just cut through, and working downward toward the point. When within about one inch of the latter it will be possible to withdraw the center therefrom; which do, leaving a tube with an internal diameter of about three sixteenths of an inch. A shoulder can now be cut on the "middle" end of the stump, and a paper or metal tube handle fitted over it. Or a glass test-tube answers the purpose admirably.

Next take some sheet cotton or cotton wadding and pare it into very thin sheets. Thoroughly impregnate these on both sides with electrotyper's plumbago, and cut up into pieces measuring three by two inches.

A piece is then rolled up (pencil form) very tightly, and inserted into the stump, about one eighth of an inch protruding from the pointed end. Some spare rolls of the leaded cotton may be inserted in the handle for future use.

The instrument is now ready for use as a broad pencil or stump, and can be used alone or preferably in conjunction with a stumping pad which has been lightly charged with plumbago. When the lead has become exhausted in the cotton, it will help to replenish it, or a little of the cotton can be withdrawn and a piece snipped off with the scissors, so that a recharged portion is presented. The advantages of the instrument over the air-brush are: Increase of speed, freedom from grain, and also cheapness; while it is superior to an ordinary stump, becaues it produces softer results, and also works more speedily. It will not work cleanly enough upon ordinary retouching medium, but the following varnish takes it nicely. This varnish is soft enough to "rub down," and yet is more damp-proof than the usual extra-hard negative varnishes, as I have demonstrated by repeated trials. In fact, it comes next to thick celluloid varnish in damp-resisting qualities. It is also a simple recipe, from which ingredients often recommended have been excluded because microscopical and chemical analysis have proved them to be deleterious.

Take of orange shellac, 6 to 10 drams; gum sandarac, 6 ounces; pure oil of lavender (spike oil will not do), ½ ounce; methylated alcohol, 40 ounces.

Digest together, thoroughly dissolve with the aid of gentle heat, and filter before use.

The proportion of shellac determines the hardness of the varnish. If a lot of nigrostyle or stump work is usually required, use the minimum quantity. The maximum quantity given will make the varnish more damp-proof, less liable to abrasion, but less capable of receiving depth of hand work. A higher percentage of shellac makes it refuse to "rub down."

Use the varnish hot, and "bake" it well afterward, for as the film is thicker than the usual negative varnish it takes more hardening. When dry, dust over with finely powdered gum resin or sandarac, and rub up with the fingers until the surface is evenly matted all over the film. Be careful not to rub through to the gelatine film. Also remember to remove all excess of powder with a tuft of cotton before retouching. After all hand work has been finished, dust lightly with powdered talc before printing. This helps to fill up the pores of the varnish, thus preventing silver stains in damp weather and tackiness in summer.

Another adaptation of the nigrostyle is in local reduction or intensification by chemical methods. For this purpose make it of bone, cork or vulcanite, charge the cotton with the chemical solution required and proceed to work.

Local reduction may also be accomplished with its aid by charging the cotton with tripoli and alcohol, when it will reduce obtruding parts as if by magic. The tool, properly prepared, has the firmness of a pencil coupled with the softness of cotton, and hence we are enabled to accomplish a variety of tasks with its aid.

An Appreciation of the Color Work of Henrietta Hudson

Despite the fact that many years have passed since the Lumière color plates first astonished a waiting world with their marvelous capacity for reproducing colored objects in the natural colors of the subject, I have never got much pleasure or satisfaction out of the color work done by amateurs and professionals with these or any of the other color plates since introduced. Here and there, a few workers have produced interesting and beautiful results, but the general average of color plates as exhibited during the last few years has been disappointing.

I voiced this disappointment in referring to the color section at the recent exhibition of photography held at the National Arts Club, New York, last October. Praise was there given, however, to a set of color transparencies, including a marvelously clever color reproduction of a soap-bubble sent to the exhibition by Henrietta Hudson. This reproduction of a soap-bubble was a fascinating bit of work, displaying an unusual understanding of color problems and cleverness in technique. It excited my curiosity and I sought to learn more of Henrietta Hudson and her work.

The end of my search was a very pleasant hour spent, in company with Thomas Coke Watkins, the editor of "The Photographic Journal of America," and Roger B. Whitman, whose work in architectural photography is well known, in the laboratory of Henrietta Hudson at 456 Riverside Drive, New York City.

Mrs. Hudson's recent color work, in photographing the interiors and stained-glass windows of the Cathedral of St. John the Divine, the reproduction of jeweled settings of precious stones, flower compositions, and the making of color records for the illustration of advertising, has excited considerable comment among those well fitted to judge of the excellence of work in this direction. It marks a new departure in direct color reproduction, not only because of its exquisite fidelity to the subject, but also by its subtle reproduction of the qualities which usually escape the average worker in this field, such as the delicate bloom of the flower and the translucency of the gem with its internal reflections of light, etc. One critic ventured to voice the suspicion that the work was not "straight" but "obviously faked." It was to set such a suspicion at rest that Mrs. Hudson invited Mr. Watkins, Mr. Whitman and the writer to give her work and her methods the closest scrutiny.

It is difficult to describe in type the peculiar good qualities of color work which the reader cannot have before him for judgment. I must, therefore, content myself with saying that Mrs. Hudson has established a new record in the reproduction of color by means of the Lumière autochrome plate. It is certainly safe to say that never in the history of photography have precious stones, including combinations of jewels and pearls, been reproduced with such exquisite fidelity, or with such technical exactness as to brilliancy of light and color, transparency, reflection and relief as in the examples shown us by Mrs. Hudson.

Her methods are her own and strikingly individualistic, but perfectly straightforward and without trick of any sort. Her results, to be sure, have been achieved by daring departures from the method of working laid down in the instruction books. But these departures seem to have been based upon an unquestionable, and apparently intuitive, grasp of color and the problems concerned in its reproduction. Mrs. Hudson modestly says that she is but an amateur in photography and has gathered her knowledge from the magazines. It is evident, however, that she has brought to her reading and has put into her work an enthusiasm and a thoroughness possessed by few amateurs or professionals, and that the wonderful color pictures she has made are the result, not only of this extraordinary enthusiasm and thoroughness, but of a wonderful perception and appreciation of color, combined with incredible patience and a lot of hard experimental work.

Notes and Comment

If one may judge by the illustrated catalogue, the Fifth International Photographic Salon, held at the Palace Hotel, San Francisco, under the auspices of the California Camera Club, must have been an unusually brilliant affair. The list of exhibitors includes the names of the majority of American pictorial workers, and the quality of the exhibits, again judging by the clever reproductions in the catalogue, was apparently quite equal to that attained in any previous exhibition in this country. Over two hundred prints were shown out of almost fifteen hundred submitted, including several examples of pictorial photography from Europe and Canada. I do not find any mention of color photography as represented at the Salon, which seems to have been confined to prints in monochrome. A detailed review of the Salon with reproductions of some of the pictures may be seen in the January number of "Camera Craft" (San Francisco, 10 cents), but those who can secure a copy of the catalogue will obtain therein a more satisfying glimpse of the Salon and its pictures. I presume that copies may be purchased at a price from the Secretary of the California Camera Club, San Francisco.

The very interesting description of Hicrography and the Hiblock, given in our advertising pages month by month by Mr. Henry Hess, the president of the Hess-Ives Corporation, should not be overlooked by those who are seeking a simple but reliable method of obtaining photographs in colors. Hicrography, in a word, is the simplest of all photographic color processes, as may be seen by the booklet which Mr. Hess will gladly send to any reader applying for it. He may be addressed at 1205 Race Street, Philadelphia, Pa.

"Chemistry for Photographers," by William Ruthven Flint. 1916. 205 pages. Cloth $2. American Photographic Publishing Co., Boston, Mass.

At last we have an American photographic chemistry and, happily, one that I can recommend as altogether satisfactory. Mr. Flint's volume is made up of papers published in "American Photography" with some additions and tables. The author has written for the photographer without much scientific or chemical learning. His style is simple and direct, dealing first with the chemical principles whose application forms the foundation of photographic methods, and giving point to this technical information by introducing a series of illustrative experiments by which the reader may visualize for himself the reactions and processes described. Second, he has incorporated with the text much useful information dealing more directly with manipulation, such as solubilities, formulas, etc. Those for whom chemical symbols are stumbling-blocks will thank Mr. Flint for omitting them in his text and stating the different reactions in the common names of the chemical substances used.

The first four chapters of the book deal more or less with the theory of chemical and light reaction and silver salts, after which separate chapters are devoted to the chemistry of the different processes in photography. The appendix contains the usual tables of chemicals, atomic weights, metric measures, poisons, developer and other formulas, with a useful bibliography and a good index.

The spring is coming and the flowers. Which may serve as a reminder that J. Horace McFarland's "Photographing the Flowers and Trees," very fully illustrated, is still obtainable. In no other book can the photographer secure so much practical and expert instruction in this fascinating and profitable field as in Mr. McFarland's monograph, which tells not only how to photograph flowers and trees but how to turn the photographs into profitable illustrative material afterward. The little book is profusely illustrated, and sells at 50c.

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Success with the Hand Camera

By success with the hand camera as here written is meant just what every beginning amateur wants: the ability to get a good picture every time. Every failure to get a good picture means disappointment and waste of time and material. At least one-third of the beginner's exposures with the hand camera are failures. Out of these failures the amateur gets no satisfaction whatever. They are accounted as experience and simply enrich the manufacturer whose products are used in the work. This large proportion of failures is not at all necessary and can be halved or quartered if the beginner only knows how to avoid them. And this knowledge —the key to success with the hand camera—can be put into a formula of three words: Know your camera. The most complete of textbooks written about this formula could not add anything to its content, though it doubtless would uncover and explain some of the thousand and one details hidden in the three words. The expert, who gets a good picture every time, uses no other formula. And the reader who will follow me in the adventure here proposed—the mastery of the formula—will, in turn, possess this key to success, the ability to get a good picture every time without disappointment or waste of time and material.

Hand Cameras in General

First, a paragraph or two about hand cameras in general, since there are so many different varieties that every other amateur seems to have one that differs from that of his neighbor. As far as the measure of success here discussed is concerned, it matters little what sort or variety of hand camera the reader has, or whether it cost $1 or $100. There are those who think that the size or kind or cost of the camera controls the quality of the pictures made with it. Put this idea away entirely. These details have nothing to do with the quality of the picture, although they apply in a very practical way to the efficiency or range of capacity of the camera to give good photographs of different classes of subjects and under widely different conditions. Which is simply to say that the dollar camera has its limitations, and not that it cannot give you pictures as good as those made with the $100 camera. As a matter of fact it can and does. This is involved in our formula. If you know your camera, you will know its limitations: what it can do and what it cannot do; when and where it can give you a good picture; and where and when it must fail for lack of capacity or power.

On What Success Depends

So, the big fact to lay hold of is this, that the quality of the pictures you get depends chiefly on your knowledge of and familiarity with your camera, its different parts or movements and the work they are designed to do. This can be obtained very simply, and at little or no expense, by a careful study of your camera and its handbook, accompanied by patient, persistent drill in its manipulation until every part and movement is thoroughly mastered.

Camera Essentials

Whatever form the camera may take in the hands of its maker, whether it is a rigid square or rectangular box, or whether it is collapsible, folding in upon itself for compactness and convenience in carrying, it consists essentially of a little light-proof box or chamber with a lens at one end (the front) and a device for holding, and perhaps changing, the sensitive film or plate at the other end (the back). The vital thing about the camera is that it must be so constructed that no light can enter and so reach the light-sensitive film or plate, except through the lens in the front when this is opened to make the exposure. Add to these a mechanical device called an exposure shutter, usually placed near to or in the lens but sometimes fitted immediately in front of the plate or film, which uncovers and again covers the lens or plate and so controls the period of exposure; a device which will tell us when the subject we want to photograph is included or falls within the limits of the film or plate in the camera; and another device which will adjust the separation or distance between the lens and the film or plate, so that the picture image of the subject will be agreeably defined or focused on the film, and you have all the essentials of a hand camera.

Non-essentials

There are many other devices attached to hand cameras, designed to regulate or control the use of its parts or to do other things which either add to the efficiency of the camera or its convenience in use or increase its capacity for doing different sorts of work. But with these additions we are not at present concerned.

Only Three Essential Operations

Let us now get back to our formula and stay with it until we have mastered its meaning and significance. In the making of a good picture with the hand camera there are only three essential operations or things to be done. These are "finding" the subject, focusing it upon the film or plate, and making the exposure. Presuming that the camera is loaded with film or plate ready for use, a good, pleasing, or successful picture is bound to result if you point the camera at the subject, "find" the particular part or arrangement of the subject desired on the "finder," focus its details to your satisfaction, and then give the sensitive film an approximately correct exposure. Whether you get in the negative just that view or arrangement of the subject seen by the eye at the time of photographing depends upon your knowledge and use of the "finder." Whether the picture is properly or pleasingly defined or focused in the negative depends on your knowledge and use of the focusing device fitted to your camera. And whether your picture correctly reproduces the light and shade or illumination of the subject as seen by the eye when the photograph was made, depends on your knowledge and use of the lens and shutter which, together, control the exposure.

Exposure

There is much to be learned about exposure as a practical problem, apart from the intelligent use of lens and shutter. This lies outside of our formula but is essential to success. We will take up these three vital factors in order: "finding," focusing, and exposure, and see what is involved in a practical knowledge of them.

Finding the Subject

"Finding" and "finder" are new and unaccustomed terms in the ear of the beginner in photography. What do we mean by "finding" the picture? Simply making sure that the particular subject or view of a subject we desire to record will appear in the negative—all of the subject or detail desired and not part of it—and that the details or chief parts of the subject will be arranged in the negative as they are in our view of the subject itself. In view cameras and all cameras before the hand camera was invented, this "finding" of the picture was done by means of a ground-glass screen as large as the plate used, placed at the back of the camera. The modern roll-film hand camera rarely has any means of using such a ground-glass screen at the back, although the reflecting-mirror hand camera (e. g. Graflex) is fitted with such a screen at the top of the camera. For this reason all hand cameras are fitted with a device known as a "finder," which tells at a glance just what view or part of the subject will fall within the boundaries of the plate or film and so will appear in the negative. By the proper use of the finder we can not only tell what will appear in the negative, but by slight changes in the position of the camera, we can control the position occupied in the negative by any part of the subject.

Brilliant or Box Finders

The form of the finder differs according to its type or the fancy of the maker. Thus we have "box" or "brilliant" finders, direct-vision finders, and full-size focusing-view finders, all doing the same work in different ways. Most hand cameras are equipped with the box or brilliant type of finder, consisting of a little box completely closed in on all sides or a metal framework, with a small lens at one end which projects the image of any object before it on to a tiny mirror placed at an angle behind it, which mirror in turn reflects the picture image vertically onto a small square of ground-glass placed horizontally above the mirror. If the viewing-screen on which the little picture is seen is a lens instead of a piece of ground-glass, the picture image has greater clearness or brilliancy and the finder is known as a "brilliant" finder. Such finders are in fact miniature reflecting-mirror cameras. The size of this type of finder varies with the size of the camera, from ¾ inch to 1¼ inches; it is always absurdly small and "finding" with such view-finders is always difficult and tedious in practice. With all box and brilliant finders it is essential to look straight down at the center of the viewing-screen, in order to see the subject correctly as it will appear in the negative. If viewed at an angle, that is, if the eye is not immediately above the center of the finder-screen, then the view will not coincide with that which will appear in the negative. Also, if the finder is not properly adjusted for use with the lens on the camera to which it is attached, it will fail to show the subject correctly as it will appear in the negative, especially as to objects or those parts of the subject lying at the outer boundaries of the finder.

Only Approximately Accurate

At best, however, all finders of this type are only approximately accurate, for optical reasons too abstruse for discussion here, and can only be relied upon to show accurately the position of objects central or fairly central in the view. If it is found that the view of the subject obtained in the negative rarely coincides with the view seen on the finder-screen, then a careful test should be made and the defective finder corrected, if this is possible, or a new finder properly fitted to the lens on your camera. It is especially important that the finder shall correctly indicate the positions of objects within the limits of the film or plate when one is photographing objects in motion, for here we depend on the finder to tell us the position of the moving object at the moment of exposure. Similarly, in group work, fairly large figure portraiture and subjects filling the picture space.

Testing for Accuracy

The test of a finder for accuracy is a simple but rather tedious operation in the case of a roll-film hand camera. We will need a tripod or other support for the camera, some sort of focusing-cloth, a piece of ground-glass at least as large as the size of the picture made with the camera used, and a few strips of thin black paper and a little strong gum, or a small brush and a supply of black paint or varnish. Set the camera on its tripod or other support, opposite a scene including strongly marked horizontal and vertical lines, and rack the camera out to the infinity mark on the focusing-scale. Fix the piece of ground-glass in the plane usually occupied by the film or plate at the back of the camera. Now, with the head under the focusing-cloth, open the lens on the camera to its widest aperture, move the camera from side to side until the strongly marked vertical or horizontal lines are brought near to the edge of the focusing-screen. At this point, without moving the camera, carefully examine the picture image on the viewing-screen of the finder, and see whether the lines are in the same position on the finder as they occupy in the camera ground-glass. If they are nearer the center on the finder than on the camera-screen, the finder includes a wider angle of view than the limits of the negative can give, and a narrow strip of the black paper should be cut and gummed on the screen of the finder so as to exclude all that appears on the finder, but not on the camera-screen. Or it is painted out with black varnish. After correcting the vertical finder in this way, reverse the camera and correct for the horizontal view in the same way.

If on the other hand the testing shows that the finder registers less of the scene than is included on the camera-screen, then either mental allowance should be made for this in your photographing or a new finder must be bought, properly suited or adjusted to the lens on your camera.

Other Limitations of Finders

It should also be remembered that the finder will always fail in accuracy in photographing objects near to the camera. Every photographer knows that as he brings his camera nearer and nearer to an object, he has to rack out his lens more and more in order to focus that object sharply, until at last, when the image is the same size as the original, the distance between lens and plate is just double what it was between them when the object was at "infinity" distance. Not only is the size of the image altered, but also the angle included by the lens. But the lens in the finder, owing to its relative shortness of focus, may be used at "fixed focus" for objects much nearer to the camera than can the lens in the camera itself, and so we find that when near objects are being dealt with, the finder will include more of them than we get on the plate, and that this defect becomes more and more marked the nearer the objects are to the camera itself.

Generally, the defect is by no means so marked as it would be in the case we have supposed, namely, in copying a small object full size, but it is often quite bad enough to upset altogether the calculations of the photographer. It begins to assert itself the moment he racks out his lens from the infinity point and should be allowed for accordingly. For example, when a "portrait attachment" or any other supplementary lens is used on the regular lens of the camera, this form of finder is only roughly accurate for objects central in the subject and finder-screen.

Some cameras are fitted with rising fronts, but are so arranged that the finder remains on the baseboard. In such a case, the moment the front is raised the finder becomes more untrue, although this can to some extent be overcome by pencil lines on the finder-screen indicating the extent to which raising the front affects the image in the camera. This correction should be done by test as above described.

In other cases, raising the front raises the finder. This is almost as bad, for the effect upon the image of raising the finder bodily is much less than that of raising the lens of the camera. This can easily be seen by noting the difference between (1) the image on the screen of the camera with the lens central, (2) the image when the lens is raised say 2 inches, (3) the image when both camera and lens are raised 2 inches. By raising lens and finder simultaneously we effect change No. 2 upon the camera-image, but change No. 3 upon the finder-image, and it will be seen that there is a big difference between them which must be kept in mind.

Direct-Vision Finder

The direct-vision view-finder is so called because in its use the finding of the subject is done by looking directly at or through the finder with the camera at eye-level, instead of looking down at a reflected image of the subject as in the box or brilliant type of finder. There are two forms of this sort of finder. One consists of a metal frame, much smaller than the film or plate used but proportionate in shape, enclosing a rectangular reducing-lens, with two ruled black cross-lines indicating its center. This is hinged to a metal base and fixed to the top or side of the camera body at the back. An inch or two behind this reducing-lens (the finder-screen), which in use is turned to the vertical position, is a small metal eyepiece or sight, also hinged to the metal base, so that lens and sight can be folded down flat on the camera when not in use. On raising the camera to eye-level and placing the eye close to the eyepiece or sight and in line with the cross-lines at the center of the reducing-lens, a small but exact view is obtained of the subject just as it will appear on the film or plate. Such finders are often as small as the box-finders already dealt with, but they can be obtained in larger sizes which are altogether preferable in practice.

The Wire-Frame Finder

The most practical direct-vision finder, however, and one that every hand-camera worker should possess, unless he has a reflex camera, is the wire-frame direct-vision finder. This is simply a wire frame enclosing a space equal to the size of the film or plate in use and hinged or attachable to the lens on the camera, or the lens-front, or to the mount of the exposure shutter. If so fixed by means of a spring hinge to the shutter-mount, so that it will fold down from and over the lens and shutter when not in use, it can be carried as part of the camera itself without inconvenience. The eyepiece or sight for such a finder is placed at the back of the camera, central over the plate or film. In use, one brings the camera to the eye-level, steadying it easily against the eyebrow or cheekbone, and placing the eye close to the eyepiece or sight, and so looking directly through the wire frame at the subject.

Its Advantages

Such a finder, properly adjusted over the lens, so that the eyepiece or sight is exactly in line with an imaginary point at the center of the finder, gives almost all the advantages possessed by the full-size focusing finder-screen of the twin-lens or reflex camera. It enables one to see the whole of the subject included on the film or plate, full size, before and up to the moment of exposure; to arrange the composition to our liking; or to follow the movement of any object in motion within the field of view. The view of the subject so obtained is equally accurate for lenses of any focal length, and the differences of view obtained by the use of the rising and falling front movement of the camera are shown by this form of finder—if fitted over the lens as provided. Its size is an obvious advantage, and it requires no shielding in sunlight, and it allows for the varying angle of view included in photographing near and distant objects, except when the objects are very near, say within 10 feet.

A Disadvantage?

Against these big advantages the wire-frame finder has the single disadvantage that its use requires the camera to be held at eye-level, which is said to be a more difficult position and less conducive to steadiness than when the camera is held against the lower part of the chest or at the waist-level. This objection had greater force when bulky, heavy cameras were more generally used, but hardly applies to the small, compact models of today, many of which are not more bulky or heavier than a field-glass. Moreover, the drawing of an object or perspective of a view photographed from the level of the eye is much nearer to the view seen by the average person and generally more pleasing than a view obtained from the waistline.

Full-Size Focusing-Finders

Without a doubt the full-size focusing-finder which is one of the big features of the reflecting-mirror (Graflex) camera, is at once the most common sense and efficient of all finders for hand-camera work. It needs no description or explanation. As in the miniature box finder of the inexpensive hand camera, the picture image is projected by the lens onto a mirror hinged at an angle of 45 degrees behind it, and in turn projected by the mirror to a ground-glass screen set in the top of the camera. This ground-glass screen is of the same size as the film or plate used, and so the finding-screen gives a full-size image, showing just what amount of the subject is included on the plate and enabling the worker to inspect and focus the picture, or to follow any movement in the subject right up to the instant of exposure. Focusing the image on this ground-glass finder also focuses it on the film or plate at the back of the camera, the picture being viewed by placing the eyes at the top or eyepiece of a folding hood above the finding- and focusing-screen, which hood serves to keep out the glare of light so that the picture image is brilliant and clearly seen in all its details. The efficiency of this sort of finder could hardly be improved, except by the invention of a viewing-screen needing no hood or shield.

Summing Up

With this knowledge the reader can now get an intelligent grasp of the problem of finding the subject as an essential factor in successful work with the hand camera. If he has to depend on the small box or brilliant finder, he now knows somewhat of the measure of its accuracy and where it is likely to mislead him; that it cannot be relied upon for the exact position of objects or part of the subject seen at the edges of the finder-screen; that it is the part of wisdom to keep the important parts of his subjects, and especially figures, well within the limits of the finder near but at one side or the other of its center. And in case of persistent failure to get in his negatives what was seen to be included by the finder, he is provided with a method of testing and correcting the finder. It is evident that, where this form of finder is the only one fitted to the camera, this knowledge of it and patient, persistent drill and experiment in its use, will save many a failure and many a dollar.

It has also been made plain that the wire-frame direct-vision finder deserves his serious consideration and can, with great advantage, be added to the camera to supplement, if not take the place of, the ordinary brilliant finder. Any one familiar with the working of metals or wire can make and adjust such a finder to any hand camera with very little trouble or expense. With such a finder and skill in its use, the humblest box or Brownie or folding camera is as efficient as a reflex camera in this matter of finding, and gives the same certainty as to what will appear in the negative.

The big advantages of the full-size finder of the reflex camera have been made evident and the superiority it possesses over all other forms by reason of the ability it gives to focus while finding the image and to see every variation effected by changes in the focusing up to the moment of exposure.

With all this, I need hardly add, goes the importance of practical skill in the use of the finder, whatever its form. This means observation and practice drill in finding all sorts of subjects under all sorts of conditions and with the camera held in a variety of positions.

Height of Camera

It is obvious that the type of finder used controls the view point from which the picture is made, as far as the height of the camera from the ground is concerned. Thus a reflex camera, since one looks at the image on the finder on the top of the camera at the bottom of a hood extending at least 9 inches, gives a view of the subject as it would be seen looked at from a point 4 feet from the ground. This from the normal position. Similarly, the ordinary box or brilliant finder is generally used at a height of 5 feet from the ground, while the direct-vision finder gives the natural view of a subject as seen by the eye. For some subjects, as in a landscape with a figure or a group of figures photographed near a clump of bushes or shrubs, the height of the camera from the ground is often important, and always has a vital influence upon the relation between objects in the foreground and the background or distance in the picture.

Finally, it is quite practical to dispense altogether with the conventional finder and yet find the subject and place it properly on the plate or film. By this method the chief object in the view is centered on the film or plate and the remaining portion of the scene left to take care of itself, but it is practical as far as it goes. Thus, if the camera is of the box or Brownie type, drive a pin into the leather covering of the camera back, at the center of the top edge; hold the camera on a level with the eyes, taking care that the shutter release is convenient to one finger; and sight along an imaginary line running from the pin to the right-hand corner of the camera, moving the camera from side to side until the corner is in line with that object or part of the view wanted at the center of the film or plate. If the camera is of the folding variety and so has no corner at the front at the same height as the central pin-sight, erect a small upright, such as a pencil, and fasten it with a rubber band to one of the uprights between which the lens front moves, adjusting the length of the upright until its top is on a level with the pin-sight, and use this as if it were the corner of the camera. Mr. William H. Blacar, who gives this method in a recent issue of *Camera Craft*, says of it:

"I have used other finders with much less satisfaction. The small ones show a small image, and one that is often very indistinct on account of poor light or the strong reflection caused by light from a bright sky. Very often by the time one decides just what he does see in the finder, he doesn't see it, and the picture is gone. The direct-vision finders that go on top of the camera are better, but they are in the way and inclined to get knocked off or broken.

"The reflecting form of camera is better than these last; but, even with one of them one does not see what is going on around him. Besides, the camera is held at the height of the waist, which, in many cases, is much too low to give a picture as the eye sees it. Very often there are people, bushes, fences, or other objects directly in front of the camera where they block out the view completely unless the camera can be held at the eye-level at least. My finder may not be absolutely accurate or theoretically correct, but it gives me a surprisingly large per cent of good, well-centered pictures of moving objects, gives them to me with the minimum amount of trouble, and that is what I want."

Focusing the Picture

With two types of hand cameras, viz., the "fixed-focus" and the reflecting-mirror camera, the second term of our formula for success is practically eliminated.

"Fixed Focus"

In the "fixed-focus" camera the lens is unalterably fixed in the camera front, at such a distance from the plate or film that all objects beyond a certain number of feet away from the camera will be in focus, i. e., equally well defined on the plate, without any adjustment on the part of the operator. It is the simplest and cheapest form of hand camera and, because it obviates the difficulty of focusing, is very popular with beginners in hand-camera work. Loaded with plates or films, a "fixed-focus" camera is always ready for exposure without further adjustment than the sighting of the subject on the finder. All we have to remember is that the object to be photographed must be beyond a certain number of feet away from the camera. This "minimum distance," as it is called, varies in different "fixed-focus" cameras, according to the focal length of the lens used and the size of the largest diaphragm or opening in the lens. The shorter the focal length of the lens and the smaller the diaphragm, so much the nearer is the distance away beyond which all objects will be in focus. Thus, with a 4-inch lens and stop *f*/16, everything beyond 8 feet away will be agreeably in focus; with a 4½-inch lens and *f*/16, the nearest object must be over 11 feet away from the camera. For this and other reasons, "fixed-focus" cameras are usually fitted with simple (meniscus) lenses of short focal length and relatively low efficiency, rarely working with diaphragms larger than *f*/16, although often marked to work at *f*/11. This means a restricted range of subjects and limits the use of the camera to the brightest hours of the day and the summer months.

Nevertheless, within its scope, the "fixed-focus" camera has great convenience and usefulness. In the hands of the beginner, for example, it will usually give a larger percentage of good negatives under favorable circumstances than he could, or usually does, obtain with a better instrument. This simply because the "fixed-focus" principle leaves no room for individual judgment (and error) in focusing the subject, demanding only that nothing shall be attempted within the "minimum distance" for that camera.

Focusing Cameras used at "Fixed Focus"

Because of this advantage of the "fixed-focus" principle, many "focusing hand cameras," i. e., those equipped with focusing devices, are now supplied with "automatic focus locks," so that by simply extending the camera until the lens front is fixed to give certain predetermined distances between lens and film or plate, it will give pictures in which all objects at more than a certain number of feet away from the camera will be sharply focused on the film without any adjustment by the user of the camera. As so used, the focusing hand camera is, for the time being, converted into a "fixed-focus" instrument with all its conveniences. This automatic focusing lock was first introduced by the Eastman Kodak Company. The auto-fixed-focus device fitted to the newest of hand cameras (the Herbert & Huesgen Co's. Auto-Fixt-Focus Camera) is different in design but effects the same purpose.

The distance in feet away from the camera beyond which all objects will be in focus varies with the focal length of the lens and the stop or diaphragm used. For this reason the reader should know the focal length of the lens on his hand camera. It is always given in the catalogue from which the camera is purchased, or on the lens itself. As will be seen in later pages this question of focal length is the basis of many useful lens calculations. Taking a disc or point in the picture image not exceeding 1-100th of an inch as the standard of sharpness desired in the photograph, the following table will show the reader how to adjust his focusing camera in order to use it as a fixed-focus camera:

TABLE OF DISTANCES ON WHICH TO FOCUS

with lenses of different length and different lens-apertures (stops), so that all objects beyond half that distance will be in focus. Disc of confusion taken as 1-100th of an inch.

Focus of Lens in Inches	Diaphragm Apertures: F Values and U. S. Numbers							
	F/4 U.S.1	F/5.6 U.S.2	F/6 U.S.2.25	F/7 U.S.3.06	F/8 U.S.4	F/11.3 U.S.8	F/16 U.S.16	F/32 U.S.32
	Distances in Feet							
2½	13	10	9	8	7	5	3½	3
3	19	14	13	11	10	7	5	3½
3½	25	18	17	15	13	9	7	4
4	34	24	22	19	17	12	8	6½
4¼	38	27	25	21	19	14	10	7
4½	42	30	28	24	21	15	11	8
4¾	47	34	32	27	24	17	12	9
5	52	36	35	30	26	19	13	10
5½	63	45	43	36	31	23	15	12
6	75	54	50	42	38	27	19	14
6½	88	62	58	50	44	31	22	16
7	101	72	68	57	51	37	25	17

For example: suppose the camera is fitted with a lens of 5 inches focal length with *f*/8 (U. S. 4) as its largest aperture, and we want to use it for street-views with 20 feet as a desirable working distance. Find the focal length of the lens in the extreme left-hand column of the table, and a glance at the columns to the right will tell us that if we once correctly focus an object 26 feet away from the camera, using *f*/8, or simply setting the little pointer of the focusing device over the figure 25 on the focusing-scale of the camera, we can use the camera as a "fixed-focus" instrument which will give sharp pictures of all objects more than 15 feet away so long as we keep the lens at that position on the scale.

The Focusing-Finder

Next to the "fixed-focus" camera in the eliminating of the "focusing" difficulty comes the reflecting-mirror camera, such as the Graflex. With such cameras there is no guess work or arbitrary adjustment of the lens at any fixed distance from the plate, but, by means of a focusing rack-and-pinion movement you rack the lens front in and out, nearer to or farther away from the film or plate, until the subject is in focus on the ground-glass screen or full-size finder on the top of the camera. By this method any desired refinement of the focusing or definition of the subject is obtainable at will, e. g., you can get maximum definition at any desired part of the subject, with the necessary result that all the other parts of the subject will be slightly less sharply defined as they lie in front of or behind the point or plane of principal focus. This is an advantage where emphasis is desired on any particular object in a scene, as in pictorial photography and in portraiture.

The Focus Problem

Which brings us to the more difficult problem of focusing the picture (i. e. getting the subject in focus or sharply defined on the film or plate) with the every-day folding, focusing hand camera. Since such cameras are rarely equipped with a ground-glass screen at the back for this focusing operation, the focusing of the picture image is done by means of a scale. This is usually a small plate or tablet of metal or ivory fixed on the base of the camera at one side of the lens when the camera is at its normal extension. It is marked by cross-lines, against which are figures intended to represent feet, meters, or yards. At the base of the uprights or front board carrying the lens and shutter, a small metal pointer projects, and as the camera is extended and the lens front moves forward on the base, this pointer moves over the lines on the scale and the lens can be clamped or fixed at any desired point or distance from the film.

The Use of Focusing-Scales

The use of the focusing-scale presumes the ability in the worker to correctly estimate or guess the distances of objects away from the camera. This is the great big difficulty in focusing by scale. To get a sharply defined picture of any object before the lens, we first estimate the distance of the object away in feet and then set the pointer over that figure on the focusing-scale, moving the lens front forward or backward until the pointer is exactly over the line marked with the figure representing the distance away (in feet) of the object to be photographed. If we measure the distance with a tape and so get the actual distance, and set the pointer over the scale accordingly, then we will get a sharply defined picture of the object in the negative. But if we estimate or guess the distance (which is the universal habit), then whether the subject is sharply defined or not depends on the accuracy of our estimate or guess. So focusing successfully by scale depends chiefly on our skill in estimating the distances of objects lying in front of the camera, the placing of the pointer over the right line of the scale being a simple matter requiring only care to fix the pointer precisely on the line representing the number of feet we estimate the object to be away from the camera. Few people can estimate distances correctly. The ability, however, can be acquired with patience and practice, and the hand-camera worker should school himself deliberately in this detail, measuring and pacing such generally used distances as 10, 15, 20, 25, 30, 50 and 100 feet until he can depend on the accuracy of his guess when working in the open without tape or measure.

Limiting the Necessity

This necessity for accuracy in estimating distances in focusing by scale applies chiefly to the near distances, i. e., when objects at 10 to 40 feet away are to be included in the picture, as in street-views and similar scenes popular with the amateur. It applies with equal force when we desire to get any particular object in or part of a subject sharply focused with the other parts of the subject softly defined or less sharply in focus. These details are explained in the paragraphs on "hyperfocal distances" and "depth of focus" in later pages. Suffice it to say here that the lenses fitted to the small cameras now in general use will, so to speak, take care of the focusing of objects lying farther away than 25 feet without any trouble on the part of the photographer in estimating their precise distance. So, it comes to this, that when photographing near objects by scale, or when near objects are included in the subject, the reader must correctly estimate the distance of these objects if he desires them sharply defined in the picture. Where there are no conspicuous objects in the scene nearer than 30 or 40 feet, or the chief interest in the view is more than 40 feet distant, the exact distance of such objects is not of great importance.

Kodak Range-Finder

An ingenious device recently introduced to overcome this difficulty of estimating the distances of near objects is the Kodak Range-Finder, as yet fitted only to the new 3A Kodak Special. It is apparently intended for the accurate focusing of objects within 50 feet away from the camera, and is used instead of the focusing-scale. The device consists of three mirrors and a tiny prism, built in the base of the standard supporting the lens and shutter on the camera. In use, the camera is pointed at the subject and the Finder shows three brilliant images of the principal objects in the view (not all the area or full field of view included by the camera lens, so it cannot be used as a view-finder). Generally, at first inspection, these three images, each representing part of the subject, do not present the subject with its natural continuous unbroken outline. For example, in the triple image of the figure of a boy, the head may appear away at one side of the body, and the limbs do not connect with the lower part of the torso. By turning the focusing-screw, the head is placed properly on the body and the limbs brought into their proper position, so that the outline of the figure becomes normal and continuous in line. This indicates that the figure is correctly focused on the film or plate. Incidentally, this adjustment of the outline on the Range-Finder brings too the focusing-scale pointer over the correct figure on the focusing-scale. For objects at 50 or 100 feet away, of course, the quickest way to focus is to place the pointer of the focusing-scale over the lines marked with these figures, the hyperfocal distance of the lens ensuring sharpness for all objects at these distances.

Focal Length

Everyone using a hand camera should know the focal length of the lens fitted to it, and the use of this knowledge. The focal length of a lens is a term used to express the distance between the center of the lens and the plate when a distant object is sharply focused on the latter. It is an important detail, because (1) it determines the scale or size in which an object at any given distance from the camera will be reproduced in the picture. The rule here is that of an object at any given distance from the camera, the longer the focal length of the lens, the larger will be the image obtained. Thus, if in photographing any object 100 feet away from the camera, with a lens of 4 inches focal length, we get an image of the object 1 inch high, then a lens of 8 inches focus will give an image 2 inches high. Of course, the bellows extension capacity of the camera, or the length of the camera body, if it is of the rigid box form, must be sufficient to allow of the separation of lens and plate to give a sharply defined image or the lens cannot be used with the camera. The practical result is that hand cameras are usually fitted with lenses somewhat short in focal length, i. e., very little longer than the diagonal of the plate or film in use.

Angle of View

(2) The focal length of the lens in relation to the base-line measure of the plate used with it determines the angle of view, or amount of the subject included in the picture. The longer the focal length of the lens, the narrower is the angle of view on any given base-line. For example: a 6½-inch lens will include an angle of view of 50 degrees on a 3¼ x 5½ plate, used in the horizontal position, but if the plate is used in the vertical position, as in figure-work or in photographing a church or monument, then the lens will include an angle of view of only 35 degrees. The field of view included on any given plate or film by the lens on your camera, when used in the vertical or horizontal position, can be seen in any table of angles of view, such as Woodman's Table (in any yearbook) or in the diagram on page 166, THE PHOTO-MINIATURE No. 76, or at page 66 of No. 134.

Diaphragms: Apertures

Next to focal length, a practical knowledge of the apertures or "stops" of the lens fitted to your hand camera will be found most useful in solving the focus problem. This because (1) the minimum distance beyond which all objects will be sharply defined or focused in the negative varies according to the focal length of the lens and the aperture used, and (2) the depth of definition or "depth of focus" capacity of the lens (its ability to sharply define near and distant objects in the view) is also based on the relation between the aperture in use and the focal length of the lens in each particular instance.

All lenses are fitted with a series of apertures or stops by which the amount of light passing through the lens in a given time may be regulated at will. In all except the simplest and cheapest lenses, this series of apertures is arranged for in a device known as an iris diaphragm (made of thin leaves of rubber or metal overlapping each other), which, when closed, completely covers the lens and prevents any light from entering the camera. By moving a small lever, the leaves open in iris form from the center of the lens, giving a series of apertures of pre-determined size, indicated by numbers on a scale on the lens or shutter, until the largest available aperture is obtained, giving the full light-passing capacity of the lens. Thus the extreme speed or rapidity of a lens is known by the number or figure indicating its largest aperture. For example, if this aperture is one-fourth the focal length of the lens the figure will be *f*/4 or U. S. No. 1 and so on.

Systems of Numbering

Several different systems are used for the numbering of lens-apertures, much confusion arising from the lack of uniformity in this detail. In one of these systems, known as the Uniform System, and applied to all Kodak lenses, the lens-apertures are so graded or arranged, from the largest to the smallest, that each succeeding aperture is about half the area of the aperture preceding it, and requires double the exposure which the preceding aperture would require. This system is a material help in calculating exposures as there is a definite and easily remembered relation between the exposure required with any one aperture or stop and that required with any other in the series. According to this system the apertures are numbered 1, 2, 4, 8, 16, 32, 64, 128. In some Continental systems arbitrary figures are adopted.

For such cases the system of the particular lens-maker must be known.

A second system, very widely used and often spoken of as the rational system, numbers the lens-apertures by figures representing the relation between the diameter of the aperture and the focal length of the lens. For example: if we have a lens of 4 inches focal length, and the diameter of the largest available aperture is 1 inch, that aperture is known as *f*/4, being one-fourth of the focal length of the lens. Reducing the diameter of the aperture to half an inch we get *f*/8, equaling one-eighth of the focal length of the lens, and so on down to the smallest aperture, *f*/45, which is 1-45th of the focal length of the lens. A disadvantage of this system, which is known as the *f*/ value system, is that it provides no fixed ratio between one aperture and another, simply expressing the light-passing capacity of each aperture by a figure which tells us the relation between the diameter of the aperture and the focal length of the lens. Thus we have apertures numbered by this system as follows: *f*/4, *f*/4.5, *f*/5.6, *f*/6.3, *f*/7.7, *f*/8, *f*/11.3, *f*/16, *f*/22, *f*/32, *f*/45.

Comparisons

By putting these facts about lens-apertures in tabular form we get a helpful idea of the comparative speeds or rapidity of lenses numbered by either system, from the practical viewpoint of the exposures required with them.

U. S. Nos.	1		2			4	8	16	32	64	128
F/Value Nos.	*f*/4	*f*/4.5	*f*/5.6	*f*/6.8	*f*/7.7	*f*/8	*f*/11.3	*f*/16	*f*/22	*f*/32	*f*/45
Expos. Ratio	1		2			4	8	16	32	64	128

This table tells us that, with any given subject and set of conditions, the lens with *f*/4.5 (U. S. 1¼) as its largest aperture will give us the picture image in one-quarter of the time required by a lens with *f*/8 (U. S. 4) as its largest aperture, and in about one-sixteenth of the time required by a lens whose largest aperture is *f*/16 (U. S. 16).

Application

Now let us look at the practical application of this in hand-camera work. Suppose we want to photograph a subject when either the light conditions or the movement of the subject requires an exposure of 1-50th second with *f*/4.5.

If we have a high-grade, expensive hand camera, fitted with a lens working at *f*/4.5, we can get a good photograph by simply setting the shutter to give 1-50th second exposure. But if the largest available aperture in the lens on our camera is *f*/8 (U. S. 4), the best we can do in the circumstances is to set the shutter at its lowest speed, generally marked as 1-25th second, and risk getting either an under-exposed negative or one showing movement in the subject during the exposure. If the hand camera is fitted with a single lens (meniscus achromatic), the largest aperture in which rarely exceeds *f*/16, then it would be well to leave the subject alone, simply because with that aperture the exposure should be one-third of a second to get a good photograph, and that is impossible with the camera held in the hand or because of the rate at which the subject is moving. Fortunately the majority of the subjects photographed by the thousands of amateurs who use inexpensive hand cameras are secured under such favorable light conditions (e. g., between 10 A.M. and 3 P.M. on bright days from May to September out-of-doors) that good negatives are possible even with the lenses of such limited speeds as *f*/11 and *f*/16 fitted to such cameras. At the same time this explains why the most frequent cause of failure is under-exposure, so many subjects being attempted which are beyond the light-passing capacity of the lens on the camera. It will be equally obvious to the reader that, with a lens working at *f*/5.6 or *f*/6.8, one's chances of success with different subjects are enormously increased; and we can photograph at times and under conditions where good pictures would be quite impossible with a lens requiring exposures eight or sixteen times longer than those possible with the rapid lens, which explains, in large part, why the high-grade hand camera with an *f*/4.5 lens is worth (what it costs) fifty times as much as the little simple box camera, with an *f*/16 lens, sold at a dollar! Reference to standard tables of exposures for different classes of subjects and times of day and year will show, however, that for almost all hand-camera work, except subjects involving rapid movement, speed work generally and abnormal conditions of light, a lens whose largest aperture is *f*/6.8 will meet all requirements, while *f*/8 (U. S. 4) is speedy enough, even for slow-moving objects at a fair distance from the camera on bright days from May to September, and *f*/11 (U. S. 8) is quick enough for the average outdoor subject without large dark objects near the camera.

The Table on Page 115

With this information about focal length and apertures we can now make good use of the table of Hyperfocal Distances given on page 115. This array of figures should not affright the reader. It is a valuable help, and he need not concern himself with more than one of the lines of figures it gives. In many instances a part of one line will be all he can use. This table gives the minimum distances beyond which all objects will be sharply focused with the lens on your camera and any of the apertures available with the lens. For example: if it is a 5-inch lens, with stops or apertures marked U. S. 4, 8, 16, 32, 64 (or *f*/8, *f*/11, *f*/16, *f*/22, *f*/32), find the figure 5 in the extreme left-hand column of the table and pass along the line to the column headed *f*/8 (U. S. 4), which tells you that the hyperfocal distance for that lens and aperture is 26 feet, and that all objects beyond 13 feet way from the camera will be pleasingly defined or focused in the picture. The next column, headed *f*/11.3 (U. S. 8), shows that by using that aperture you can get objects beyond 10 feet away in focus, and so on to the end of the line. This knowledge makes focusing by scale an easy matter, provided the worker has some degree of skill in estimating the distances of near objects, and so will help him to success in the use of the hand camera.

Depth of Focus

Now we can take up "depth of focus" and see how a practical mastery of this helps. In order to get all we desire of a subject clearly and sharply defined in the negative, it is usually advised to focus sharply on some object in the middle distance of the field and then "stop" the lens down, that is, use a smaller aperture, to get subjects fairly near the camera in focus. But a better way is to know the depth of field capacity of the lens on the camera at different apertures and apply this knowledge in your work. Theoretically, a lens can give a sharply defined image only of objects at one point or, as we say, lying in one plane, in front of it. But, practically, we find that the lens will give a more or less sharply defined image of objects somewhat in front of and behind this point or plane of critical focus or definition. The range of this distance is spoken of as the depth of field, or depth of focus, of the lens. This depth of focus depends on the relation between the focal length of the lens and the aperture or stop used with it. Generally speaking, it increases as the focal length of the lens and the size of the aperture decreases. Thus, of two lenses of the same speed, but unequal in focal length, the lens of shorter focal length will give the greater depth of focus. This explains why a 5 x 7 enlargement, made from a pocket-camera negative, with a 3-inch lens working at *f*/4.5, will have more depth of definition than a 5 x 7 contact print from a negative made with a hand-camera fitted with a 7-inch lens working at the same speed, viz., *f*/4.5. It also explains why the pocket-camera lens, regardless of the aperture or stop used, gives pictures with greater depth of definition than those made with the larger hand camera where the same apertures are employed, but with a lens of greater focal length.

Calculating Depth

Knowing the focal length of the lens and the *f*/ value of its apertures, as marked on the lens itself or on the shutter, it is a comparatively simple matter to figure out just what amount of "depth of focus," i. e., the distance or range of depth between the nearest and farthest objects which will be in focus when the lens is focused upon an object at a given distance, we will get with any lens and any given stop. If the reader will do this for the lens on his hand camera, the information so gained once for all will serve him as a most valuable aid in getting good photographs.

Hyperfocal Distance

First we need to know the hyperfocal distance of the lens. This can be seen at a glance, for lenses of focal length from 2½ to 7 inches, for all the apertures in use, by a glance at the Table of Hyperfocal Distances given on page 115.

The Rule

To use this Table to learn the maximum depth of focus available when you focus sharply on any particular object in or part of a view, proceed as follows: (*a*) Multiply the hyperfocal distance given by the Table for your lens and the aperture in use (in inches) by the distance of the object (in inches). (*b*) To find the nearest point or object which will be in focus, divide the sum of (*a*) by the hyperfocal distance (in inches) *plus* the distance of the object focused on (in inches). (*c*) To find the farthest point which will be in focus, take the sum of (*a*) and divide it by the hyperfocal distance *minus* the distance of the object focused upon. The distance between the nearest and farthest points in focus is the depth of focus available with your lens and the stop in use for any object at the distance chosen for the point of particular focus. For example: we want to know the maximum depth of focus available when we focus sharply on an object 12 feet away from the camera, with a lens of 5-inch focus and aperture *f*/11 (U. S. 8). The Table tells us that the hyperfocal distance for that lens and stop is 19 feet. Then 228×144 inches $= 32{,}832$ inches $\div 228 + 144 = 88$ inches (7 feet, 4 inches) is the distance of the nearest object which will be in focus. Again: 228×144 inches $= 32{,}832$ inches $\div 228 - 144 = 391$ inches (practically 33 feet). Thus the Table tells us that if, using a 5-inch lens at *f*/11 (U. S. 8), we focus sharply on any object 12 feet away from the camera, the depth of focus available is practically from 7½ feet to 33 feet away from the camera, and that all objects in or portions of the view within these distances will be satisfactory as to sharpness in the picture. It also tells us that, with that lens and aperture, all objects beyond 9 feet away will be in focus, and that we get the maximum depth of definition in the picture by focusing on an object 19 feet away.

Working Out a Table

This knowledge and its use is by no means as confusing as it looks in type. Knowing the focal length and apertures of the lens on your hand camera, the Table and formula just given will enable you to work out a special table for your lens, telling at a glance the depth of focus available when an object at any given distance is sharply focused, as well as the distance on which to focus to obtain maximum depth. For example, I give Lambert's table for a 5½-inch lens and the usual apertures.

TABLE SHOWING DEPTH OF FOCAL FIELD WITH LENS OF 5½ INCHES FOCAL LENGTH

U. S. 2.5 F/6			U. S. 4 F/8			U. S. 8 F/11			U. S. 16 F/16			U. S. 32 F/22		
5	**6**	7	5	**6**	8	4	**6**	8	4	**6**	9	4	**6**	12
7	**8**	9	6	**8**	10	5	**8**	12	5	**8**	16	4	**8**	26
8	**10**	13	7	**10**	14	7	**10**	17	6	**10**	27	5	**10**	72
9	**12**	16	8	**12**	19	8	**12**	25	7	**12**	50	6	**12**	Inf.
10	**15**	23	10	**15**	30	9	**15**	43	8	**15**	300			
11	**20**	38	11	**20**	55	10	**20**	160	8	**16**	Inf.			
16	**25**	61	14	**25**	121	12	**23**	Inf.						
17	**30**	105	15	**30**	625									
19	**36**	272	16	**32**	Inf.									
21	**42**	Inf.												

Observe that under each aperture we have a set of three numbers in horizontal line. These are distances in feet. The middle number is the "focus" point, that on the left the "near," and that on the right the "far" point. Thus, with *f*/11, if we focus on a point 8 feet away, our near point is 5 feet and our far point 12 feet.

Exposure Shutters

After the lens, the exposure shutter must be known. This is usually placed before the lens (as in the cheaper cameras having single lenses); or between the elements of a doublet lens (as in the better grades fitted with rectilinear or anastigmat lenses); or immediately in front of the plate or film (as in the reflector or focal-plane cameras). The last-named stands first in efficiency, next the between-the-lens or diaphragm form, and last the simple form, which consists of a metal plate pierced with an aperture which is thrown across the lens by means of a lever. The simple shutter gives two exposures: "instantaneous," i. e., 1-20th second, and "time." The diaphragm shutter gives (or is said to give) exposures indicated on a speed scale, usually extending from 1-100th or 1-300th second to 1 second, with additional movements for "time" and "bulb" exposures. The focal-plane shutter ranges in exposure capacity from 1-1000th of a second to slow automatic speeds of 1-10th to 5 seconds, or it can be opened for focusing or time exposures.

In the cheaper cameras, the "instantaneous" movement of the shutter is often too quick for the rapidity of the lens, i. e., does not allow sufficient time for the required amount of light to pass through the lens-aperture. Save under the most favorable conditions of lighting, this defect often gives rise to under-exposure in hand-camera work. Diaphragm shutters are usually made in the form of an iris diaphragm, opening and closing from and to a central aperture. As a certain fraction of the total exposure is necessarily absorbed in this opening and closing of the shutter, it follows that the efficiency (or light-passing power) of such shutters cannot be as great as that possessed by the focal-plane shutter, with which we get all the light passed by the full aperture of the lens, this being clear during the whole period of the exposure. This loss of actual efficiency in diaphragm shutters varies in different designs where large lens-apertures are used, but is not so great when smaller tops are employed, as in such instances the full working aperture of the lens is wholly free during the largest part of the exposure period. On the other hand, this type of shutter favors the better definition of near and far objects.

Set the Shutter

Among the various diaphragm or lens-shutters available, some are known as automatic (i. e., the shutter sets itself ready for the next exposure after use), while others have to be set with the hand after each exposure, except for "time" and "bulb" exposures. This point needs particular attention in your camera drill as many of the amateur's early failures result from "forgetting to set the shutter" before exposure, the result being a blank and wasted film and the loss of what might have been a masterpiece. First, change your plate or film ready for exposure, then set your shutter.

The Lens-Hood

Before leaving the lens and shutter, let me not omit a mention of the lens-hood. Strange as it may seem, this invaluable aid to securing crisply brilliant negatives with the hand camera is rarely touched upon in any of the articles I have seen dealing with the subject. The necessity for compactness in the hand camera has resulted in a method of mounting the lens so that it is practically flush with the front of the camera in almost every model I have seen. This means that the lens in this class of cameras has to do its work without any protecting flange. When it is remembered that the modern anastigmat is made to cover a fairly wide angle of view and is of short focal length with a large aperture, it will be seen that this combination needs, most of all, a protecting flange or some sort of shade or hood over the front of the lens, in order to avoid flare and that general veiling of the plate or film which inevitably results from scattered light reaching the lens from every direction. Flat and foggy negatives may result from photographing against the light, from over-exposure, from a misty condition of the atmosphere at the time of photographing, and from the use of a warm developing solution or a developer too strong in alkali, or from the lack of a safe light during development. But it is probably true that more flat and foggy negatives result, in modern hand-camera work, from the lack of a lens-hood than from all these causes put together. Unfortunately lens-hoods are not at present obtainable commercially in this country, but they can be made or extemporized very simply, and the reader will find several designs for this purpose in The Photo-Miniature No. 158, "Photographic Apparatus." Any device which will shade the lens from excessive light-impact, without cutting into the field of vision of the lens, will serve as a lens-hood. A collapsible circular hood formed by two thin brass tubes sliding within each other, the rear tube fitted so that it will just snugly hold to the slightly projecting lens-flange on the camera front, and both tubes coated with dead matt varnish inside, is one of the best forms I have seen. It was first made by C. F. Nicholson.

Holding the Camera

An expert in hand-camera work, familiar with the exposures of thousands of beginning amateurs, tells us that a very large percentage of the beginner's failures result from not holding the camera steady during the exposure. The finest lens, the most careful focusing and expert shutter handling will be all unavailing to secure a good photograph unless we have learned how to hold the camera steady while making the exposure, and proficiency in this respect is the more necessary the slower the speed of the shutter and the lighter the camera. As full exposure of the plate for the average subject means a shutter speed of 1-20th to 1-40th second, and as the general preference is for a light folding camera, it is necessary to give attention to this point in camera drill.

First, it is desirable, where possible, to hold the camera firmly against some support if the exposure is to be longer than 1-25th second. By practice it is possible to hold the camera steady for exposures of 1-10th or 1-15th second, but this skill is rare. If a post, fence, tree, or angle of wall can be found, all the better. If one is not near such aids, then the body is used. Just where the camera ought to be pressed against one's person depends on the subject. If very near and rather low down, e. g., a figure or animal, the camera ought to be held level and low down, not pointed downward. For this purpose one knee may be placed on the ground and the other caused to form a supporting table. For average subjects the waist-level is most convenient, and here, with a bulky or heavy camera, a great aid is to sling the camera by a light strap going round the neck, and to keep it steady by a slight downward pressure. Pressure of the camera against the chest is, again, a good position, whilst a very firm support is secured by pressure against the chin or lips. If a direct-vision view-finder is used (at eye-level) then the camera back can be held steady against the eyebrow or cheek-bone. Bear in mind that one can overdo the pressure business; pressure can be maintained so tightly that it becomes almost convulsive and defeats its very object. Just hold the camera firmly, but with some elasticity, and make a habit of holding the breath for the instant of exposure. All the better, too, if this instant comes when the lungs are deflated.

Exposure

This brings us to the third term or factor in our formula for success with the hand camera, viz., the exposure. Let me confess, before going further, that the problem of what exposure to give is far too big, and involves too many different parts, for any attempt to solve it satisfactorily in the space here remaining. But perhaps I can point out the simplest way along which the reader may solve it for himself. In the calculation of all exposures, certain factors are vital and must be considered in relation to each other and then collectively. These are: time of day and season of the year; weather or atmospheric conditions; subject; speed of film or plate; lens-aperture. By correctly estimating the relative and collective values of these factors we arrive at a period or time of exposure which, in practice, is best expressed in some definite shutter-speed.

Three Methods

There are three ways of calculating exposures: (1) By instinct, or a sort of intuition, which can only be acquired by practice and familiarity with the handling of exposure factors under different conditions—this the professional photographer and experienced amateur uses; (2) by the use of an exposure meter, such as those offered by Watkins, Wynne, Heyde, the Imperial, Harvey's Meter and Steadman's new Aabameter, all of which are thoroughly reliable and well worth their cost to any amateur as giving him an intelligent insight into the mechanics of exposure, as well as the particular exposure he seeks to know at the moment; and (3) by the use of an exposure calculator of which one of the best is the *American Photography* Table of Exposures, obtainable for a song. But, regardless of the method employed, or to be employed, the reader should first of all read, and re-read, a reliable textbook on the subject, such as may be had in THE PHOTO-MINIATURE Nos. 54 and 105 (if the former can be obtained). In these little textbooks the all-important factors controlling exposure are simply explained in detail, and from them the reader can obtain a common-sense understanding of the problem which will lead him far on his way to the successful use of meters and calculators, or to dispensing with them altogether. In learning to calculate exposures by any system much dependence is put upon one's judgment of the values of different conditions, such as a clear day, or dull, foggy weather, the illumination of the subject and similar variable factors. Skill in this comes only by observation and experience.

A Simple Introduction

The simplest and most elementary introduction to the subject of exposure is that given by Dr. Mees in a recent issue of *Kodakery*, which follows. Dr. Mees reduces the controlling factors to two in his preliminary, but, presupposing his readers to be users of Eastman film, the second factor is eliminated forthwith. This does not in any way detract from the practical usefulness of what he tells us since, in the Table he gives the other factors of time of day and season, subject and weather are properly included as necessary to the calculation, the result of which is expressed in the columns headed "shutter speed" and "stop."

Dr. Mees' Method

"The exposure to give depends on two factors: (1) the strength of the light, and (2) the sensitiveness of the film; but since the sensitiveness of the film always remains the same, we need only consider the light which reaches the film through the lens.

"In order to find out how much light is reaching the film during exposure we must consider (1) how much light there is coming from the sky, (2) what sort of subject we are photographing, so that we can know how much of the light it will *reflect*, and (3) how big a lens-opening is being used.

"Let us assume that the exposure is made at *f*/8—the stop which is marked 4 in the Uniform (U. S.) System. We can then calculate the exposure for any other stop, since stop *f*/11 or U. S. 8 requires twice the time of exposure that stop 4 does; *f*/16 or stop U. S. 16 requires four times, and so on.

"If we take as the standard subject an ordinary landscape showing the sky, without any heavy foreground, groups and street scenes and landscapes with dark foregrounds will need twice as much exposure as this standard subject, and portraits and scenes in the shade of trees or houses will want four times as much exposure, while sea or open beach or snow scenes will want only half the exposure of the standard subject. This rule, then, will enable us to deal with different kinds of subjects.

"But there is one subject for which no rule is really satisfactory, and that is a photograph taken inside a room, whether it is a photograph of the room itself or of a person sitting in the room. Only experience or some method of measuring the light inside the room will enable the exposure under such circumstances to be judged accurately, but for a first trial about 400 times the exposure should be given that would be given on the standard landscape out-of-doors.

"The light falling on the subject depends on what one may call the light-conditions at the time, and these depend on three factors—the time of year, the time of day and on the weather.

"If we take as our standard time the middle of the day—10 to 2—in the late spring and summer, then during the middle of the day in the fall and winter, or during the hours between, say, 8 to 10 and 3 and 5 in spring and summer, twice as much exposure should be given, while during the same hours of the morning and afternoon in the fall and winter the exposure should be four times as long.

"Turning to the weather, we may call bright sunlight the standard. When it is cloudy bright, that is, when there are light clouds over the sun, double the exposure will be required. When it is cloudy dull we shall have to give four times, while when the clouds are very dark and the day is gloomy, eight times the exposure will be needed.

The Calculator

"Now, having classified the time and the weather and the subject, we can best put the whole matter in the form of the table given below:

Subject	Figure	Exposure Table		
		Index No.	Shutter	Stop
Snow, sea and beach scenes	½	½	50	16
Ordinary landscapes showing sky	1	1	50	8
Groups, street scenes, landscape no sky	2	2	50	4
Portrait (outdoors) shaded scenes	4	4	25	4
Interiors, portraits indoors, etc.	400	8	*B	16
TIME OF YEAR AND DAY				
Spring and summer—middle of day	1	16	*B	8
Morning and late afternoon	2	32	*B	4
Fall and winter—middle of day	2	400	†T 4 secs.	4
Morning and afternoon	4	800	†T 8 secs.	4
WEATHER		Above 800 give proportionate extra time.		
Sunny	1			
Light clouds over sun	2			
Cloudy, dull	4			
Heavy clouds, very dull	8			

*Use a tripod or place the camera on something rigid to hold it still, press and release shutter quickly (¼ second).

†Use a tripod and give exposure indicated.

For sharp results take care to judge distance correctly.

"In order to use this table, find the figure given for the *subject*, the figure given for the *time* and the figure given for the *weather* and multiply them all together. The number obtained by multiplying them together we can call an index number, and then if we look at the exposure table on the right we shall see given there the shutter-speed to use and the stop number at which the diaphragm should be set. It will be remembered that Stop 4 means *f*/8, Stop 8 means *f*/11 and Stop 16 means *f*/16.

"From this table it will be seen that when the index number is greater than 4 we cannot give an instantaneous exposure and the only safe thing to do is to use a tripod or place the camera on something rigid, to hold it still. When the index number is either 8, 16 or 32, set the shutter to B and press the shutter-trigger and release it as quickly as possible. When the index number is 400 or 800, set the shutter to T and use a watch for timing the exposure. Remember that in indoor photography it is always essential to use a tripod and give a time exposure.

"Let us take an example of the use of this table: Suppose that we are photographing at the beginning of July and in the middle of the day, then the figure for the time will be 1, but if the weather is cloudy and dull the figure for the weather will be 4, and if we are taking an ordinary landscape the index number will be 1. 1 x 4 x 1=4. The numbers in the Exposure Table opposite 4 tell us we must set our diaphragm at Stop 4 (*f*/8) and the shutter at 25.

"By using this little calculating table, we shall be able to get a much better proportion of good exposures than we could possibly get by guesswork."

Finis

With which good word our adventure ends. As was said in the beginning photography with a hand camera is a big world, and one cannot hope to compress it all into a few pages of type. But, basing it upon the three terms of our formula: finding, focusing, and exposure, its problems and perplexities are perhaps made more easily comprehensible. I have tried to make the formula as interesting as the brevity of its consideration would permit, and I am still firm in my belief that, if the reader will earnestly and patiently master what he has provided for him in these pages, he will possess the key to success with the hand camera—the ability to get a good picture every time, with no disappointment or waste of time and materials.

Notes and Comment

Dr. C. E. Kenneth Mees, of the Eastman Research Laboratory, Rochester, N. Y., recently spent a few days in New York, giving illustrated lectures before the American Institute of Graphic Arts, the Science Department of Columbia University, and the Chemistry Department of the College of the City of New York. It was my good fortune to be present at the first lecture, given in the rooms of the Advertising Men's Club, where the subject of his talk was "The Theory of Reproduction," explaining in a very interesting and practical way the fundamental problem of photography, viz., the reproduction of the scale of tones in the subject by a corresponding scale of tones in the print.

Beginning with a blank white lantern-screen, Dr. Mees showed how all objects or parts of objects lying in different planes are represented by different tones in the photograph. Thus, by adding five tones of different depths on the screen, he built up the image of a cube. Proceeding, by means of diagrams and reproductions from photographs, Dr. Mees explained the significance and range of contrast which occurs in natural objects. For photographic purposes, a scale of 1-4, in which the brightest thing is four times as bright as the darkest, is very low, and such a subject would be called flat as to its tonal range; a scale of 1-10 gives a medium soft tone contrast, 1-20 strong contrast, 1-40 very strong, and 1-100 an extreme range of contrast. All these degrees occur in natural subjects such as landscapes. From this it follows that in a photographic subject we have to consider two points, namely, the scale of contrast which it is the purpose of the photographic process to represent correctly by an identical or similar scale of contrast in the black-and-white print, and also the total average brightness of the subject, which is of importance only so far as exposure is concerned, a low average brightness in the subject involving a longer exposure than a high average brightness.

The measurement of light intensities and the calculation of the exposure curve of plates and papers were next dealt with, the apparatus and methods used in the Eastman Research Laboratory being clearly explained on the screen. The variation of the scale of contrast by increasing the time of development was interestingly touched upon, together with the great variation in the gradation capacity of different sorts of sensitive material, plates and papers.

Pointing out that by reason of this variation in gradation capacity many printing papers fail to correctly render the scale of tones secured in the negative, Dr. Mees emphasized the importance of using a printing paper capable of reproducing the full scale of tones recorded in the negative, as an essential factor in securing a correct reproduction of the original subjects.

The subject was one which does not lend itself to condensation here, but as handled by Dr. Mees, it held the interest of those who were present for the best part of an hour and a half. At the end of the lecture, the Kodachrome process of color photography was briefly explained, and its possibilities in portraiture, photo-micrography, and in the making of moving pictures, were demonstrated on the screen by numerous examples of the method.

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The British Journal Photographic Almanac 1917, edited by George E. Brown. 780 pages. Paper covers 50 cents, cloth $1, postage extra. Henry Greenwood & Co., London. American agents, George Murphy, Inc.

This year, "because of the War," American photographers are enjoying their copies of the popular "British Journal Almanac" before their British co-workers have had so much as a glimpse of it. At this writing the book has not yet been published in London, but the American edition is, we are told, fast selling out and will soon be unobtainable. The new volume, as a matter of course, lacks the prodigious bulk of a few years ago, but this slimness is due wholly to repressive limitation in the advertising pages. The wonder is that there are so many advertising pages in the circumstances, and they offer convincing proof of the enterprise of the British photographic trade. The principal feature of the "Almanac" this year is a connected series of notes by the editor forming a sort of first excursion into the field of chemistry for photographers, explaining in familiar language some of the fundamental conceptions lying beneath everyday photographic practice. This is followed by an "Epitome of Progress During 1916" (112 pages), and a carefully selected photographic formulary extending over 126 pages and including many useful tables and optical calculations. Among the illustrations of the "Almanac" is a gaslight print on Vitegas paper, the frontispiece being an example of rotogravure. The "Almanac" provides a plentiful supply of interesting and useful information for both amateur and professional photographers and is generally admitted to be the most comprehensive and the most generally useful single-volume photographic reference book in the language. Editor Brown deserves much praise for its preparation and the amount of interest he has compressed between its covers.

The problem of getting the best possible results out of our film-exposures without doing the work oneself is one that excites the interest of more than half the amateurs within my acquaintance. They seem to go from one trade finisher to another without material variation in results and are always looking for something better. To such anxious souls I cordially recommend a trial of the service offered by Miles Greenwood, 84 Cottage Street, Melrose, Mass. Mr. Greenwood has been for some years a sort of special Providence for hundreds of critical amateurs located in all sorts of places from Maine to California. But his individual service is open to all workers who are seeking better results than they have had, and at a price within reach even of the amateur who uses a No. 1 Brownie only occasionally. Apart from this service, Mr. Greenwood is a man whose acquaintance is well worth while, his work for the amateur being always accompanied by a letter of advice and help looking to improvement of the work by the elimination of future mistakes. He also has an Exchange Department through which old cameras can be traded for new cameras at the best possible advantage to the customer. In this department, Mr. Greenwood generally has a few "extra bargains" on hand worth inquiring about.

The patient, persistent labors of Mr. F. M. Steadman to master the problem of exposure in photography have eventuated, so to speak, in the Aabameter, a little metal case resembling the familiar silver vest-pocket matchbox, with a piece of narrow paper tape projecting at one side, forming an instrument which by means of tints on a special sensitive paper gives the correct exposure for any and all subjects. The Aabameter is accompanied by an instruction book, written by Mr. Steadman, which gives full information of the uses and advantages of the instrument. The outfit sells at $1 complete, G. Gennert, of New York, Chicago, and Los Angeles being the trade agent.

Many tides have run under Brooklyn Bridge since I foretold in these pages that the moving picture would one day play a big part in professional portraiture in the studio and at home. The thing has come to pass. For a year past, Mr. S. H. Lifshey of Brooklyn, skilled in portraiture of the better sort, has been making motion-picture portraits of children as a professional specialty. I have seen some of these films and found in them the ultimate solution of the problem of picturing the children in the best because the completest way. Mr. Lifshey has associated himself in this specialty with the Koshiba Studio, 546 Fifth Avenue, New York. The pictures are made at the studio or out-of-doors or at the residences of patrons, as may be most desirable. I am told that this newest thing in portraiture is meeting with great success.

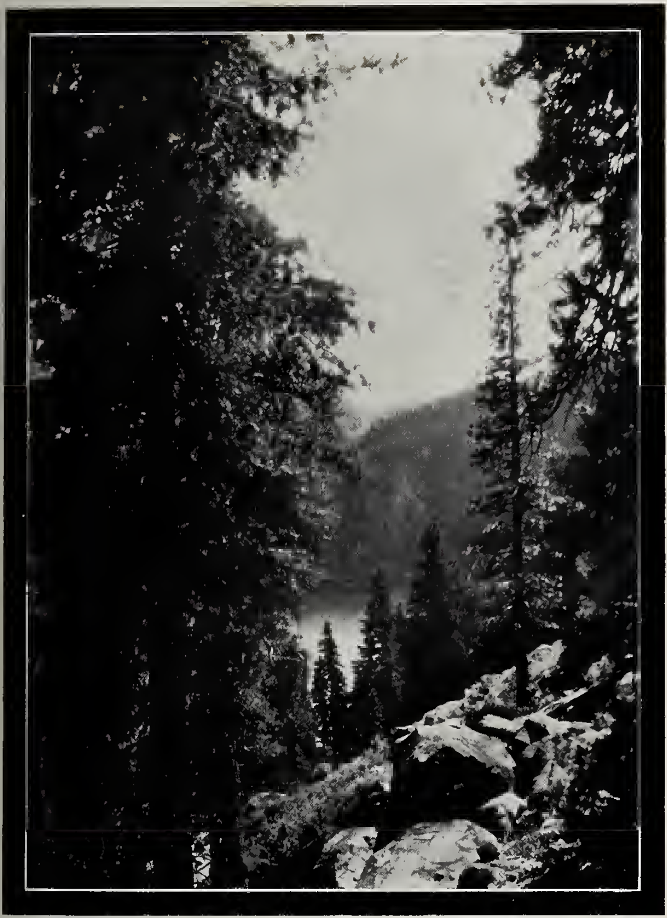
Thomas W. Smillie, chief photographer of the Smithsonian Institution and Museum at Washington, D. C., for many years, died in that city March 8, in his seventy-fourth year, after an illness of about a week. By his untiring devotion to photography during the last twenty-five years, Mr. Smillie had made himself known and loved among American photographers from coast to coast. He was the dean of the corps of photographers in the service of the United States Government, and his work in photography covered every branch of the art. As a custodian of the photographic section of the National Museum, Mr. Smillie had a special interest in the evolution of photographic apparatus and processes. On this topic he wrote several interesting papers, many of which may be found in the yearly reports of the National Museum.

Perhaps the nearest approach I have seen to an automatic exposure guide is the Harvey Exposure Meter, recently introduced by G. L. Harvey, 105 South Dearborn Street, Chicago. This handy pocket meter, which can be seen at most dealers, will help the reader over all his exposure difficulties. Take it with you when next you make an excursion with your hand camera.

A novel, but thoroughly practical camera, with a curious interest of its own, is the Finger-Print Camera introduced by Folmer & Schwing Division of the Eastman Kodak Company, Rochester, N. Y. This little camera, measuring 11¾ x 6 x 6 inches, gives a photographically accurate, full-size record of finger-prints wherever they may be found, having four miniature lamps within itself which illuminate the finger-print or other subject while the exposure is being made. The camera is also readily adapted for uses other than in criminal investigation where accurate photographic records of small articles are needed, such as records of a portion of a lace or fabric pattern, signatures, formulas, labels or a portion of written or printed matter. The Finger-Print Camera uses plates 2¼ x 3¼, giving an image of 2⅛ x 3⅛ area. It is fitted with a Kodak anastigmat working at *f*/6.3, fixed focus, giving an image of extremely fine definition. The shutter mechanism is very simple in its operation and gives perfect control for exposures of varying duration as may be needed by the subject. A Finger-Print Developing Tank can also be obtained from the makers of the camera, whereby anyone, familiar with photographic processes or not, can produce excellent negatives.

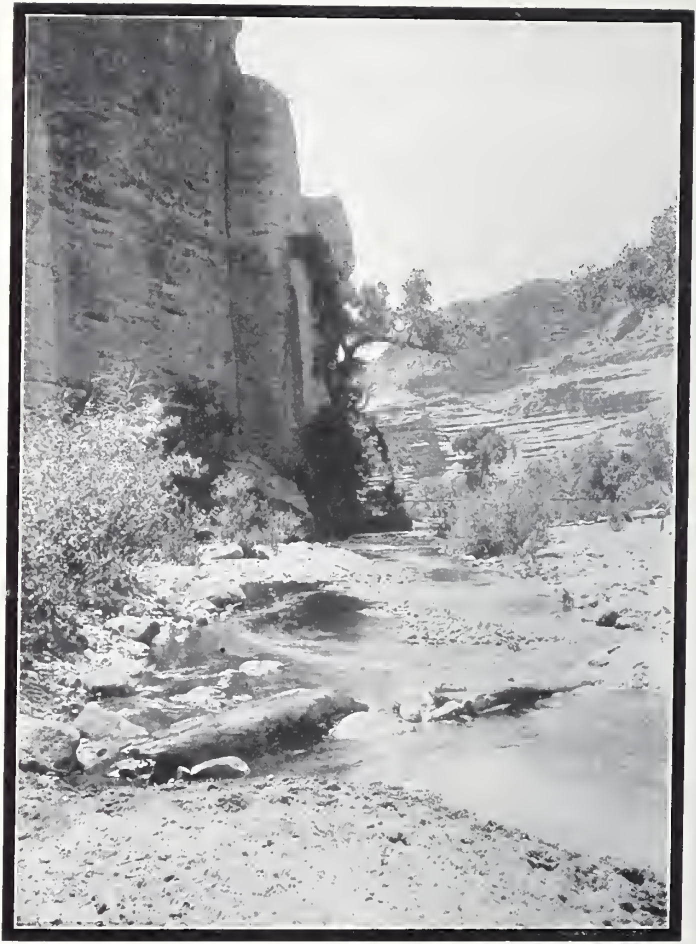
The Auto-Fixt-Focus camera introduced by Herbert & Huesgen Co., 18 East 42nd Street, New York, can now be obtained with varying lens and shutter equipments at prices from $40 to $75, including the Goerz Celor, Dagor and Syntor anastigmats and other high-grade lenses, with the Ilex Acme exposure shutter for exposures from 1 to 1-300th of a second.

Hurter & Driffield's Photo-Chemical Investigations. Writing from far Australia to thank me for a copy of THE PHOTO-MINIATURE No. 56, which deals with the work of Hurter & Driffield, Mr. B. C. Goodwin says: "The value of Hurter & Driffield's researches has been largely lost to the world, owing to the fact that a collection of their printed works cannot be had even by diligent search. Much of their work is said not to have been published at all." It may be well to remind my readers that the monograph in THE PHOTO-MINIATURE No. 56 was prepared by Mr. Vero C. Driffield for publication as a résumé of the papers on their photochemical investigations which Dr. Hurter and he had published in various scientific and photographic journals. It is hoped that the Hurter & Driffield Memorial Fund, now being promoted by the Royal Photographic Society of Great Britain, will permit the republication of all the original papers in full. Contributions to the Hurter & Driffield Memorial Fund are asked from all who appreciate the value of the work of these pioneers, and may be sent to the Secretary of the Royal Photographic Society, 35 Russell Square, London, W. C.



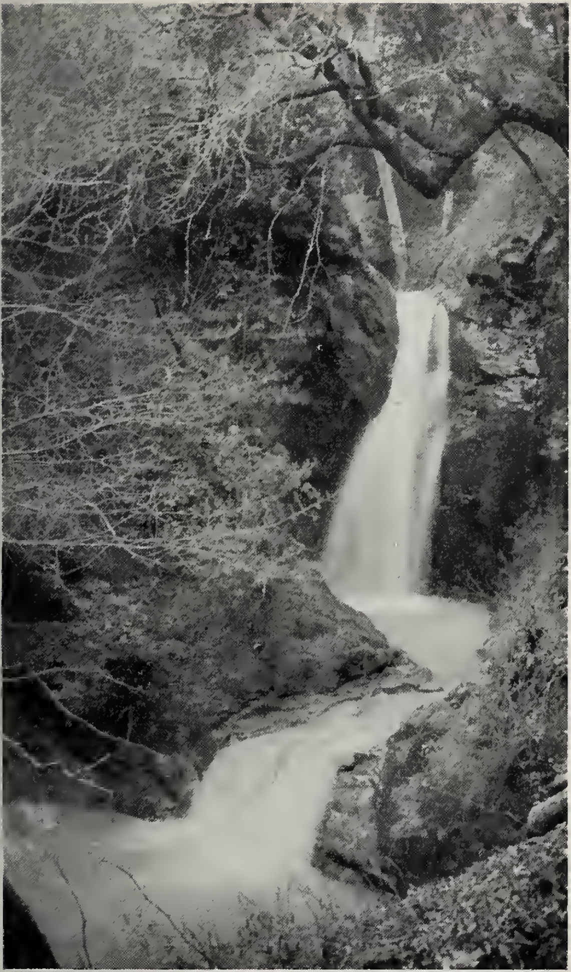
A VISTA OF TAHOE : Harry F. Sully

The shadows at the border and the line of the distant hills contrive to bring the glance back to the center of interest



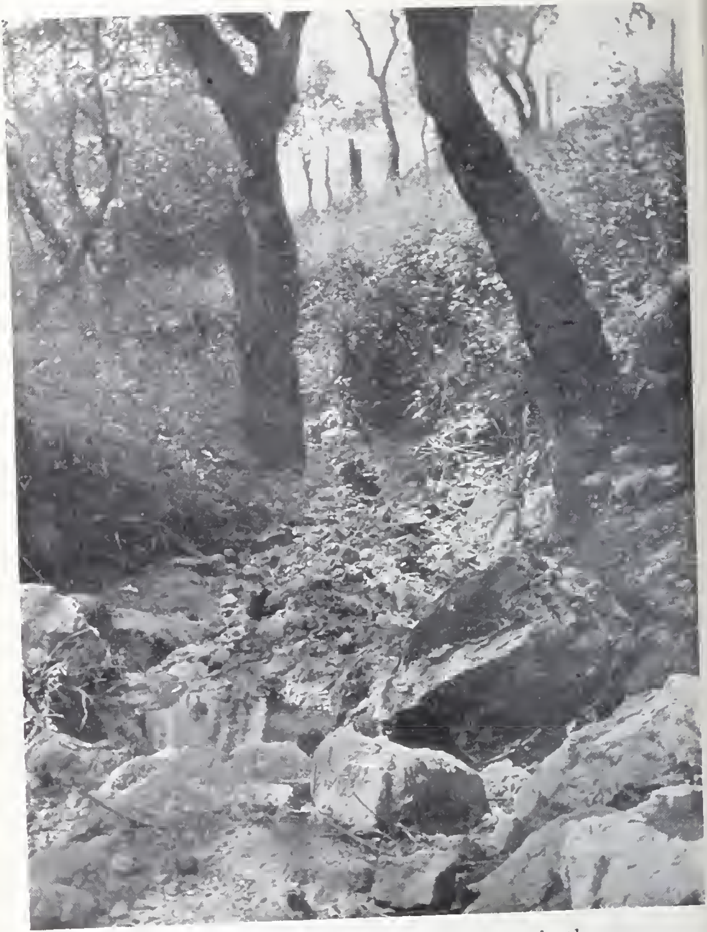
NATIVE BATTLEMENTS : Roy Harrison Danforth

Note how vertical, horizontal and curved lines are used to give variety to this composition



SUN AND FOAM : Roy Harrison Danforth

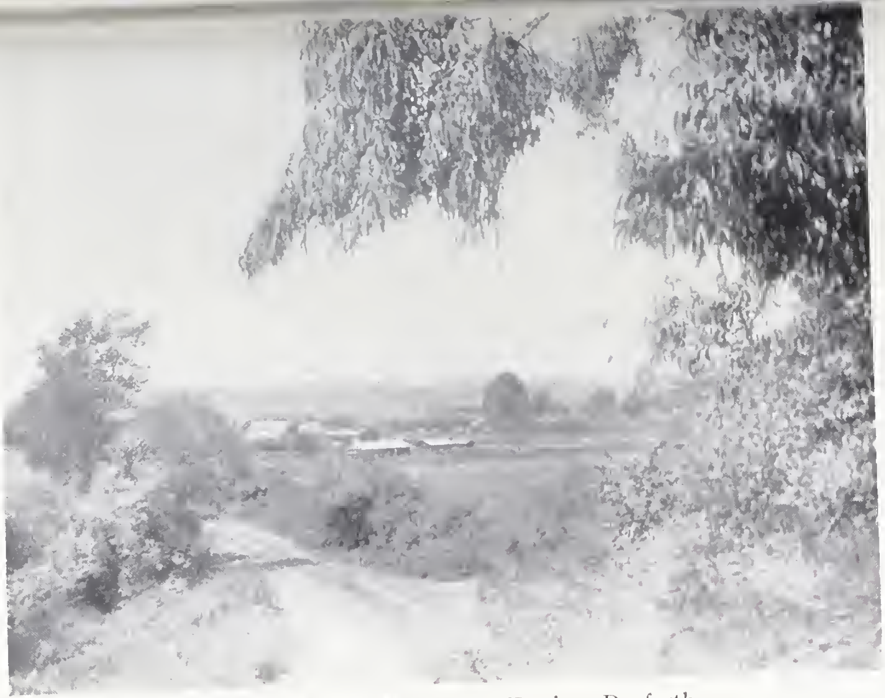
The long line of the water, broken by little detail, permits the use of much detail in the supporting parts. Note that the exposure here was sufficiently long to avoid the frozen appearance of water following too short an exposure.



NEIGHBORS : Roy Harrison Danforth

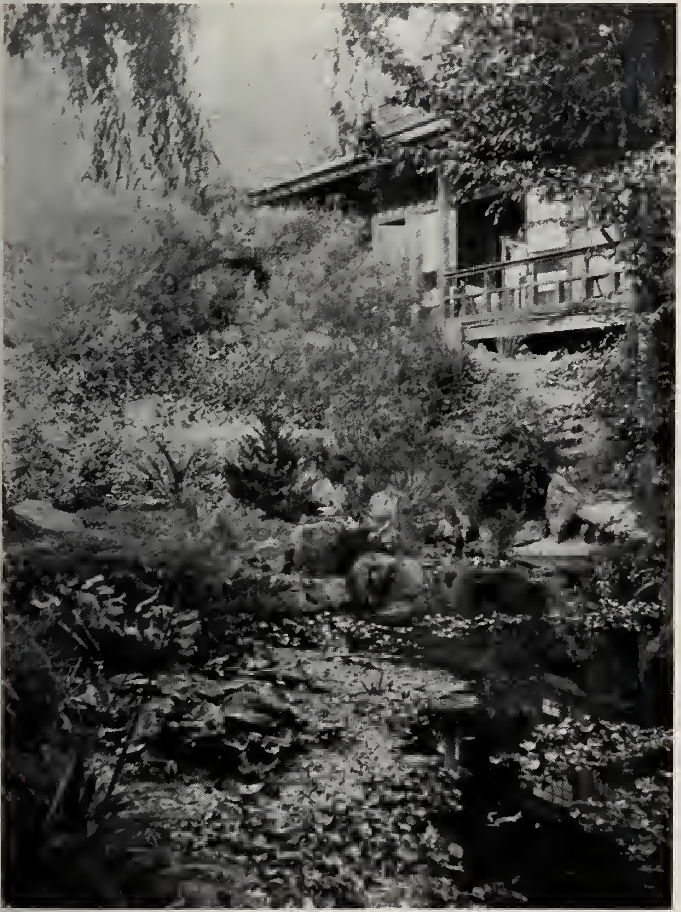
The high horizon line is often dictated by an interesting foreground and middle distance

CAMPUS PATHS : Roy Harrison Danforth



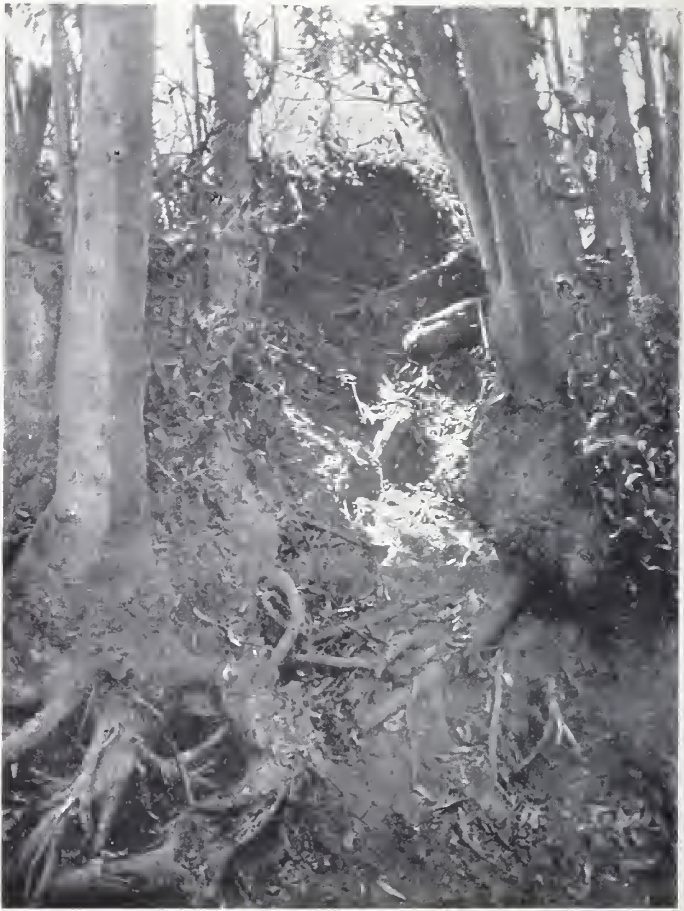
THE ROAD HOME : Roy Harrison Danforth

The entrance to this picture, the oval form of the composition, and the focusing of the glance upon the center of interest by the framework of foliage is to be noted



THE TEA HOUSE : Roy Harrison Danforth

The chief interest here—the tea house—finds balance below the center in its reflection and in the vertical lines of the foliage on the left



"STRENGTH" : Roy Harrison Danforth

Focus of light near the center of the picture emphasized by surrounding shade

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Landscape Photography

Before man was sophisticated enough to find himself his own noblest study, he had turned his attention involuntarily to his surroundings, from which he had to wrest a living, wherein he made his habitation, and to the animal life with which he had to contend. In the dawn of our kind was born, therefore, the instinct for the land from which we have never quite escaped. Because thereof we feel that the beauties of Nature are to a degree subjective, that they derive their best part from memories and associations existing in our minds. We sense the magic of a hilltop because we have learned that there is a mystery about hilltops and another side which their crest conceals. We feel the inherent glories of a single sunset, but these are enhanced by a general love for all sunsets which our experience, individual and racial, has taught us.

It is for these reasons that landscape pictures never will cease to charm or the making of them to entice. This argument explains, moreover, why the literal depicting of a scene can never completely satisfy, and why the subjective element in every artist, be he painter or photographer, must find the landscape picture a means to an end. Before the particular landscape which he will depict is at his hand, the spirit of a thousand landscapes is in his soul, and it is the reaction of the spirit upon the fact that will make the picture. The desire for landscape picturing must be a fever with the artist before he can make such pictures well.

Opportunity then will present itself on every hand. In her infinite variety of flatness and altitude, barrenness and clothedness, valley and mountain, empty plain and peopled city, Nature will furnish him amply the rough material out of which he must fashion his art.

This book essays to teach the reader the use of his materials and tools, how he shall make the landscape tell the story he wants it to tell. The feeling for the picture, the thing that a certain artist, with a snap of his finger at a painting which did not contain it, called "that," neither this nor any other book can teach. It must be evident in the beginning that if the photographer proposes to make pictures rather than mere records of fact, he must understand as thoroughly as any other artist, such as the painter or etcher, the principles of the making of pictures, and he must have the control of his means of expression that permits him to put himself into his work.

Things to be Left Undone

At the outset, understand that there are certain things which the camera cannot do. Every photographer who has pointed his lens at an expanse of many acres of land, across which the sun toward nightfall threw a mellow light, knows that the broad expanse is not within the camera's limits. It is safe to set down these rules: That no landscape be pictured merely because of its immensity; that none which depends chiefly upon color for its beauty be essayed; that the expanse which is spotted by light and shade in innumerable forms or is attractive merely for the dazzling brightness of the illumination athwart it be avoided. Really, the photographing of a great space is not necessary. A tree may suggest a forest; a house, a city; a breaking comber on the beach, the whole wide ocean. Learn first of all to find the vital part of the landscape and, when you have taken that, to stop.

Interpretation

What the concept of the landscape is to be, what the prevailing idea or emotion that justifies it, will always govern the treatment it is to have. If this treatment is to be romantic, the introduction of figures may become necessary. If it is to be merely picturesque, figures may be in the way, but a certain wealth of detail will be sought. If we idealize the road that leads into mysterious distances through the forest, we shall contrive to hide its farther reaches in mist; but if, realistically inclined, we regard the road the more highly for the definite way it goes about its business, we shall almost sacrifice atmospheric perspective to indicate in detail its final ascent to the crest of the hill; and, finally, if, as impressionists, we have taken the generalizing tendency of our sight as our guide, we shall represent the roadway as little more than a narrow and lighter-toned mass between two darker masses of trees that gradually approach it in tone as its distant end is achieved.

Expression

The subject of our prospective picture must be understood, felt keenly and sympathetically, imagined, before a decision can be made as to what its treatment shall be. Especially must we know our picture before we shall decide upon the introduction of figures. Does it take the element of "human interest" to tell our story truthfully? Is it grandeur, ruggedness, greatness, that we wish to depict, and can we conceive of the figure adding any strength to the natural landscape expression of these ideas? On the other hand, if we are to show, for instance, a storm-scourged hillside, will we not enhance the fact by picturing a man, bent against the blast, beating his way up the slope toward a lighter place in the dark sky? As a general rule, if our landscape will tell unaided what we want it to tell, let us agree to omit the figures.

The Personal Element

Above all, the lesson must be learned before we proceed farther that Nature is not art, but that art is Nature seen through the artist's eyes. Until the personal element has been brought to bear in selecting the scene and the best part of it, rearranging and adapting, emphasizing here and subduing there, removing this and adding that—in short, until the picture is made to represent, not the natural landscape, but what the artist sees in it, it is not art. "Nature is very rarely right," wrote Whistler, and therein he condemned, as all earnest workers must condemn, the mere "snapshotting" of a view and the labeling of the print from the negative thus made as art of any sort.

The Pictorial Appeal

The picture must invite the glance of the beholder to enter. It must make the subsequent journey interesting, pleasing, and harmonious. It must afford the glance a single place where it can, where it must, rest, and it must have a way for the glance to leave. Upon the accomplishment of these objects the success of a picture, so far as composition is concerned, rests. If the real picture is in the middle distance, the foreground must not be obstructed with distracting debris or the eye will stop there and never reach the picture at all. If the main item is not emphasized by subsidiary lines, by light and shade, and by its emotional weight, or if the background is itself too inviting, the attention will glide over the point where the artist sought to arrest it, and the force of what he wished to say will be lost.

Significance of Unity

While harmony of the several items in the picture space is ever to be desired, attention to it alone will produce nothing better than prettiness, while force and vigor will have gone by the board. Provide an orderly sequence of objects in the picture but leave some portion to the imagination of the beholder. Pictures demand unity just as do novels and plays. One idea must dominate every art print, and whatever is out of keeping with this idea should be avoided. This does not mean the sacrifice of variety. Millet's picture, "The Gleaners" (Fig. 9), is unified by the one idea of field labor, but not all of his three foreground figures are bent at the same angle to their task.

This necessity of the dominance of a single idea rightly understood, one of the preliminary difficulties of every picture is removed. Briefly expressed, every picture must tell one story and one only. "The great object of composition being always to secure unity, to make many things one whole, the first mode in which this can be effected," wrote Ruskin, "is by determining that one feature shall be more important than all the rest, and that others shall group with it in subordinate positions." The achievement of this aim appears simpler for the painter than for the photographer, but it is something that the latter has, by hook or crook, to reach. It does not mean that all other objects but the main one be removed from the picture—landscapes are not mere silhouettes—but whatever other objects there are in the picture shall lend their support, either by reinforcement or as foils, to the main feature. If one of several trees within our view most closely approaches our ideal, that tree is our picture, but its surrounding fellows, rightly treated, will but the more emphasize its height and straightness, or its robust and rugged contour. In short, the law of special prominence has this corollary, that all unnecessary objects must be removed and that all secondary objects must be subdued in relation to it.

Placing the Chief Interest

Where and how this object is to be placed within the margins of our picture next demands attention. The picture space is naturally divided by a vertical and a horizontal line (Fig. 1, I), and we shall easily discover the vertical line, which serves as a sort of support or fulcrum for the two sides of our picture, to be the more important. That prominence is in direct proportion to the size of the object in the picture will be at once apparent. That its distance from the center line and its dominance increase in the same ratio is made apparent by the illustration of the steelyard (Fig. 1, II). What would happen to the larger weight on the steelyard if the lesser one were removed is exactly what would happen to an item of that size in our picture if it were not supported on the other side of the central line; it would apparently be pulling the picture over upon its side—destroying the balance.

Balance

Thus enters the principle of balance, which is, that an object on one side of the center of a picture cannot be permitted to go without a compensating object or accent on the other side. These must not be of equal importance, and the size of the lesser will depend upon its removal from the vertical axis of the picture and its isolation. This conception of the "pull" which an

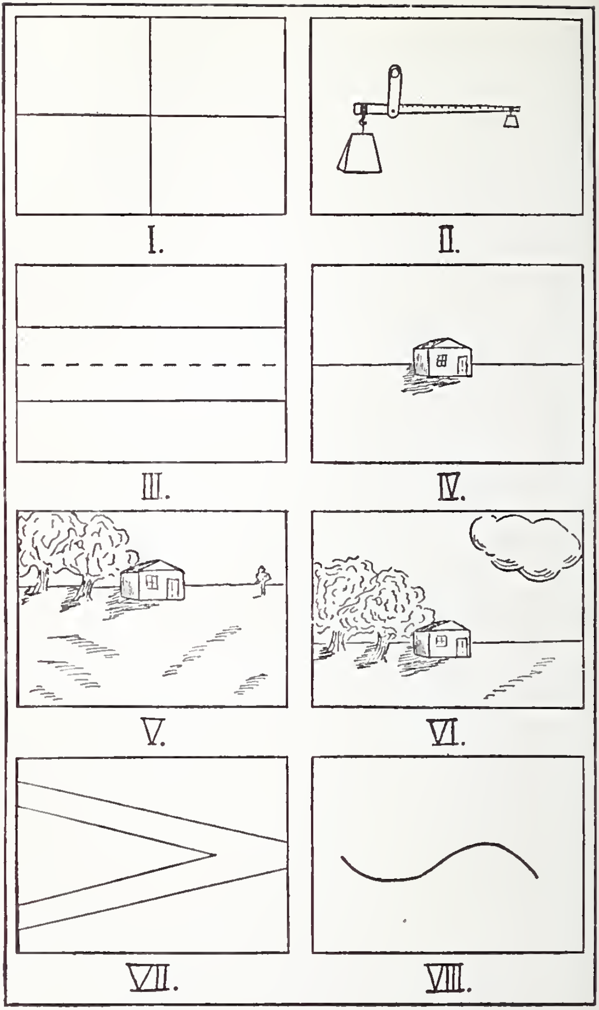


FIGURE 1. Forms of composition and balance.

object seems to acquire as it is removed from the vertical axis is worth much study. The lack of force of an object centrally located is indicated in the fourth sketch in this figure—a house at the dead center of the picture space. It is similarly located in V and VI, it is true, but the addition of the trees has made trees and house the dominant thing, and they are, as a group, far from being centered. Note how much the composition has gained in force. Note also how balance is afforded in V by the sapling to the right and in VI by the cloud. In a similar manner, on the horizontal axis, the dead center is to be avoided, as in locating the horizon line, and a higher or lower than the center position preferred. (The solid lines, for instance, in Fig. 1, III, rather than the dotted line at the center.)

Lines

The handling of lines is a weighty part of art in itself. Here are a few axioms worth committing to memory: Vertical lines predominate in majestic and dignified scenes; horizontal, in those which are serene and reposeful; diagonal, when mutability and motion are intended; and curved where grace and variety are sought. Leading lines in a picture demand balance; many cannot run in one direction without a few at an angle to them. The background line may support the dominant line of the picture but must not merely seem to duplicate it.

Contrast: Opposition

Not only in the matter of lines but, as we shall see, in tones, light and shade, and even thought, contrast is an element without which a picture cannot exist. One can conceive of a spiral arrangement of lines in a picture by which they all follow each other in a circular fashion, but it is hard to suppose that an artistic result could thus be achieved. Without opposition no object in a picture space can gain prominence, and without contrast no arrangement of lines will be better than sheer monotony. Curved line must be opposed to straight, lines at one angle to those at another, keeping in mind always as a chief object the raising in importance of the dominant object. The contrast of lines may be abrupt or it may be gradual as the pic-

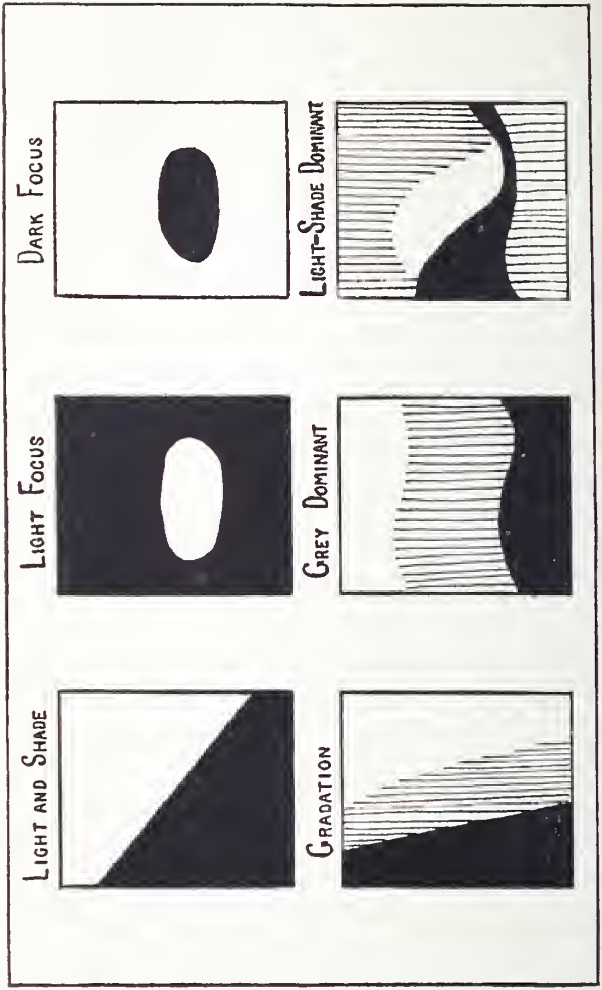


Figure 2. Forms of chiaroscuro.

ture is one of action or repose; it must never be too abrupt if spottiness is to be avoided.

Light and Shade

When we come to deal with planes instead of lines, a new element is introduced at once into photographic work—that of light and shade. To the handling of light and shade the Italians gave the name of "chiaroscuro," which may well serve us here. Between light and shade we recognize half-tones as well, and upon the handling of these three elements depends much of the effectiveness of every picture. A picture may be in a high, light key with few dense shadows; it may be in a low, dark key with restrained lights; but whichever treatment is chosen, there must be one dominating light just as there is one dominating object in the picture. No light can exist without a compensating shadow: the tree trunk that is equally lighted on all sides might as well be flat for all the roundness that will be evident. Outside the highest light and the deepest shadow, other lights and shadows must be relatively unimportant; none can approach these two in brilliance or darkness. Few pictures can exist which contain merely light and shade; it is the business of the half-tone to fill much of the picture space, uniting or modifying the light and shade. However much the lesser lights and shades are subordinated, they must not be too numerous or the picture will suffer for lack of breadth.

The forms which chiaroscuro usually takes are indicated in Fig. 2. Many landscapes, those of William Keith especially, show the light-focus in an open space in the trees or a brilliant patch of distant sky with the shadow, more or less detailed, crowding closely in upon it. The dark focus is more rare. The light-and-shade dominant is among those most frequently met. The force and boldness achieved by throwing the dominant light and shade directly together is indicated in the Emil Carlsen landscape, sketched in the general masses of light, shade, and half-tone, and without the detail of the original, in Fig. 3. In this, as in other figures in this monograph, the convention of parallel lines has been adopted to indicate half-tone.

The Range of Semi-tones

Half-tone in a photographic print is a variable matter. It includes all of those tones that lie between the light and the shadow. If it is comparatively dark, the light which it supports will appear brighter; if it is comparatively light, it will seem to add to the depth of the shadows. In any picture in which strength and power are particularly to be achieved, the use of the whole scale of light and shade which the medium permits is indicated. Delicacy, suggestiveness, mysticism, the feminine, are inherent in the brighter part of this scale; force, sternness, realism, the masculine, in the darker. Finally, the amount of light will not exceed the amount of shadow to a great extent without the

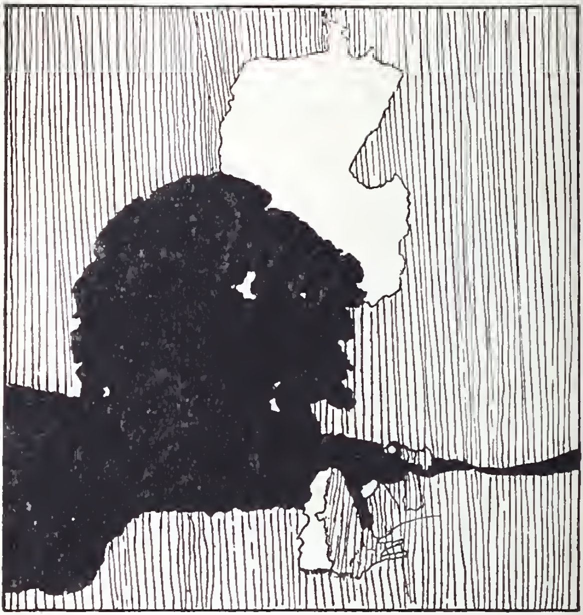


FIGURE 3. Landscape: Emil Carlsen. Bold effect secured by massing light against dark in juxtaposition.

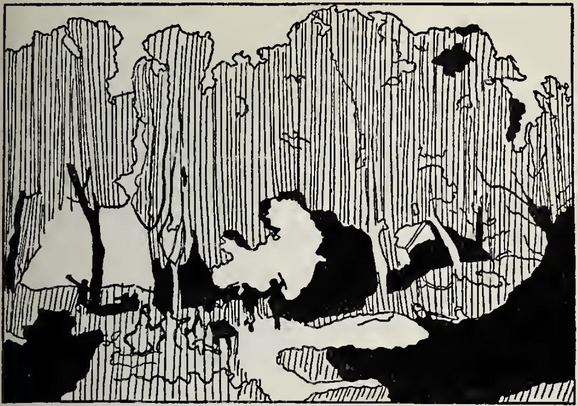


FIGURE 4. "Le Matin": Corot. Similar amounts of light and shade.

picture becoming glaring. Notice that Corot in his "Le Matin" (Fig. 4) has used shadow in sufficient quantity to relieve each of his lights.

Forms and Masses

The forms which landscape compositions may follow cannot be limited to any particular number, yet there are certain classifications which the great majority of them will assume. The oval form for the dominant subject and light is more common in landscape than the purely circular. The triangular (Fig. 1, VII) is very common,

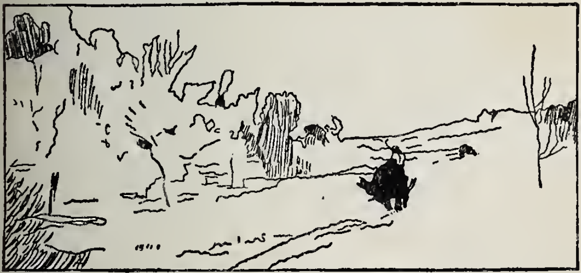


FIGURE 5. "Le Printemps": Daubigny. Triangular composition with accent at point of triangle.

being formed in compositions of trees, roads, rivers, bay shores and hundreds of other subjects. Such a form has often the most important subject strongly accented at the apex of the triangle, as in Daubigny's "Le Printemps," (Fig. 5), though in other compositions the lines of the triangle, if extended to the apex, would lead outside the picture margin. Hogarth's "line of beauty," the line of a woman's back seen in profile, is often adapted to landscape subjects (Fig. 1, VIII). It is not to be supposed that in any case the triangle or diagonal or ellipse is slavishly to be followed if the items to be used do not harmoniously fit that form.

Keep Simplicity

The means just advised for securing the dominance of a single idea in a picture will operate to secure simplicity as well and an absence of the sophistication and artificiality that are too apt to be the photographer-pictorialist's bane. The avoidance of overcrowding, the using of no more lines or masses than are necessary to tell what is to be told, work to the same end. No line need be shown in its entirety to secure its effect. It may be strong here and weak there and merely suggested by a dot farther along. If, however, an idea may be strengthened by repetition, do not hesitate to do so, only making sure that the repeating line or mass is kept subsidiary to the dominant idea.

Tone Relation

In speaking of chiaroscuro, attention was called to the fact that half-tones are of wide variation. They may be almost as dark as the shadows, almost as bright as the lights. In nature every tone, whether it is in shadow or light, bears a definite relation to every other tone. They may all be raised under the influence of strong illumination or depressed by its absence. It is the business of the artist to transcribe these tones by whatever medium he uses and continue their just relations one to another. He may transform the whole scene before him to a higher, lighter key, but these relations he must not disturb at the cost of a lack of verisimilitude. All of them are governed in large measure by the chief light of the picture, and upon the brilliance of this depend for their brilliance. Tone, therefore, does not apply to the amount of light in the picture, to which the distinguishing name of "value" is ordinarily given, but solely to the relations. We shall find soon that this matter of tone is especially of grave concern to the photographer, whose ordinary medium must be modified by the nicest calculations before it will keep the relationship accurate.

Definition: Diffusion

One could almost write a complete book of this size on the subject of definition and diffusion alone, so tough a nut to crack have they been to photographers. The photographic record books of twenty years ago are full of examples of accurate detail. One can well imagine the photographer under his focusing cloth working, as he was advised to do, with a microscope to make sure his image was absolutely sharp. Fortunately for the claims of photography to rank as a fine art, we have come well away from that fallacy. Over-emphasis of detail scatters a picture into confusing lines and planes. It makes difficult the achievement of any principality at all by offering objects that continually distract from the dominant one. The eye does not see every tiny twig on every tree unless it wants particularly to see them. If it is the tree at which the glance is directed, what is seen is an upreaching mass in a dark tone gradually widening toward the top into a larger mass more or less dark and more or less relieved by accents of light. Imagination, subtlety, suggestion are destroyed by too emphatic detail. The observer is left with nothing to do; the whole story is told; and usually the story is so long that he tires and departs before he has heard it all. This should not be construed to mean that all detail must be suppressed, that every edge must be blurred, every shadow empty. Only when the theme of the picture is in danger of destruction from superabundant detail must that detail be subordinated. "Breadth does not signify neglect of detail or finish, but simplification where unity is threatened."

Art Principles

This statement of art principles has been necessarily brief. Its brevity should not mislead as to its importance. Much as one may understand photographic technique, much as he may love Nature, his application of the one to the other will not produce artistic work until he has learned thoroughly what artistic work is. It is a study that may and should be pursued through many volumes. Once the principles of art have been learned and the determination made to use them, not as domineering masters but as helpful friends, the pictorialist's first long step is taken.

How Not to Apply Them

To the practical application of these principles it is time now to turn the photographer's attention, and first to discuss with him where he shall find the material for his pictures. Several ways of going about this can be conceived. He will have adopted the poorest of all if, with a certain rule of composition carefully conned and absorbed, he looks for a scene to be governed by it. Art may be reducible to principles, but it is not synthetized out of them. He may have determined upon the emotional motive that is to govern his picture and seek the material best fitted thereto. Unless he plans a genre study in which figures will be his chief concern and their environment only a secondary one, or unless his previous rambles have carried him through a variety of available places which he has carefully catalogued, this plan will also fail to take him far.

Seeing the Pictorial

What, in the greatest number of instances, really happens is that our photographer marches hopefully on until he comes to the scene that will make a picture and proceeds to make a picture of it. But to know that this is such a scene presupposes, on the one hand, an acquaintance with the principles we have been discussing and, on the other, such a love for Nature as will make her a constant revelation to him. He need not suppose that only the Tyrol or the fields of Picardy or Niagara Falls or the Yosemite Valley have pictures awaiting him: Nature never was so partial as that. Pictures lie at his very door, but they will be apparent to him only if he at once loves Nature and knows how to use her. One photographer has made a really artistic picture of a row of telegraph poles and a roadway winding along a river bank. Alvin Coburn exhibited at the Panama-Pacific Exposition an exquisite thing he had made out of a few very common farm buildings and some very dusty, unpromising fields.

You will find picture material along a river or a village street or a country road; in a churchyard or in the trail of a circus; among the hills and the trees or in a formally landscaped garden. Each of these will wear a different aspect on a clear day, a foggy day and a rainy day. In winter they will differ in appearance from in spring; in fall they will not be the same as in summer. The aspect of any scene, its emotional content as well, will be altered by the introduction of figures. An art gallery will have a suggestion for you in every canvas, but these must be only suggestions, not guides or copies. The photographic magazines, *Photograms of the Year*, and the files of THE PHOTO-MINIATURE will offer you similar suggestions that may be profitably used.

Study every good picture you can find, but study it more for inspiration than indication. Do not be afraid of yourself; give free play to your originality; use your own brains when you interpret Nature. Above all, when you are in the open, observe far, far more than you record. Take a long time to see and a longer time to think. The rest will follow as the night the day.

The Viewpoint

Once the general scene to be used is determined, the particular portion which will appear in the picture is selected by arranging the point of view, and this is a critical matter. As a purely artificial help, carry along a piece of black cardboard from which have been cut rectangles of various shapes. (Fig. 6.) Held before the eyes this will aid materially in finding the right details to include. A piece of blue glass will kill the color of the scene and let you see just how much of its beauty will remain in black and white. The primary step is to determine the location of the horizon line. Remember, this is not to bisect your plate; it will be high if the foreground is interesting; low if the upper portions of trees and houses are to dominate, or the sky. Make sure that the foreground, unless itself is the picture, leads easily and unobtrusively therein. The dominant object must not fall at the center of the plate, but toward the edge, and it should have a balancing object on the other side. Lines from the sides of the plate may be made to converge upon this dominant object, as in Fig. 7. Roads and paths will not lead into the picture from the lower edge but travel diagonally across the view. Do not permit tree boughs or foliage at the top of the plate to have no seeming means of support. Subsidiary lines, such as those of roads, paths, bridges and the like, ought not to lead the eye out of the picture except in the one instance of the intended exit for the sight. Subdue the others at the margin by choosing a point of view that hides or softens them

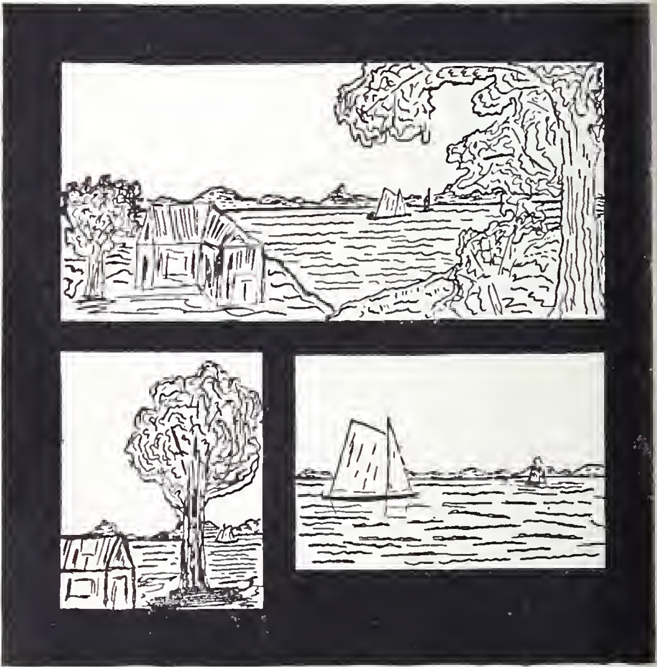


Figure 6. A viewfinder, made of black cardboard with cut-outs of various sizes and shapes.

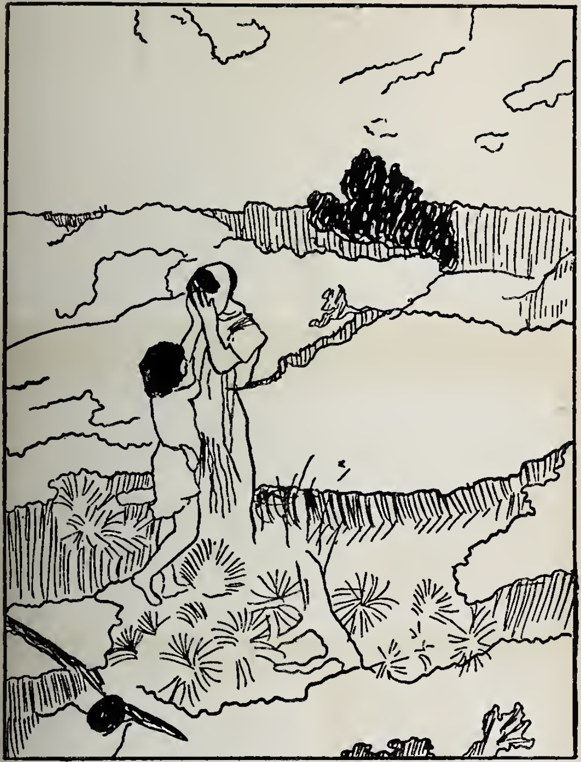


FIGURE 7. "Hagar and Ishmael." Emphasis of dominant feature by direction of supporting lines.

there. The need, so far as chiaroscuro is concerned, of carefully selecting the point of view is easily learned. Look at a tree from the lighted side or the shadow side only and you will find it is perfectly flat. It is only when you view it from an angle where both light and shadow appear that its roundness and modeling are apparent. This applies to the whole landscape as well. Remember that the camera overlooks nothing and that every offending twig and leaf and bough, every rock that offers a false accent, ought diligently to be removed. Likewise you may feel the necessity of introducing such elements where they will assist.

Time of Day Beyond choosing the point of view, selecting the best time of day is of large importance to the photographer. The house and trees in Fig. 1, V, may have little pictorial value under the harsh lighting of a July noon. But as twilight approaches, the distracting details die out of the trees, the foreground is softened and mellowed by the warmer sunset rays, the cottage roof takes on a livelier outline against the less brilliant sky, smoke from the chimney begins to offer evidence of humanity, and an evening cloud adds a needed variety: such a subject may become of artistic worth in the purest sense.

The Shadow Masses Of considerable importance as regards the time of day is the fact that thereon depends almost wholly the location of the shadow masses. If every detail of a scene is right, but its chiaroscuro displeases you, try it again at another hour or another month. The diagram given in Fig. 8 will be found of assistance. Hold the book with the top of the page toward the south. Decide from what point you want the light to come, and the line from the center of the diagram toward this point will indicate the time of year and the time of day when the sun will be in that quarter of the sky. The time of year is indicated by the months alongside the vertical line; the time of day, from 5 A.M. to 7 P.M., by the figures on the circles at each radial line.

From a practical standpoint, as well as an artistic one, it will be found that a sunset-and-water combination is better than a sunset-and-land. Exposure is difficult at that time of day on land, but the increased reflection of the water shortens the necessary time. Even this reflection may add pictorially to the result. Depicting light itself has been considered of so much value in art that one whole school of artists, the luminarists, was devoted to it. In practice the photographer will find it a simpler task if he chooses the time of morning mistiness or evening oranges and yellows than the broader glare of midday. Finally, do not fear to break the photographic primer rule of never having the light in front of the camera; some of the strongest effects often are secured that way.

Pictorial Focusing

After we have done what we may in choosing the point of view and the best lighting to emphasize our dominant object, there remains one more means at the photographer's disposal—a wise disposal of the several planes of his pictures. It is in the focusing and the use of the stops that subordination, leaving out of undesirable objects or their softening and the emphasizing of the main object are chiefly to be achieved. If our lens is focused sharply on an object 25 feet distant, we shall find that, even with our largest stop, objects a short way in front of it and a slightly longer way beyond are

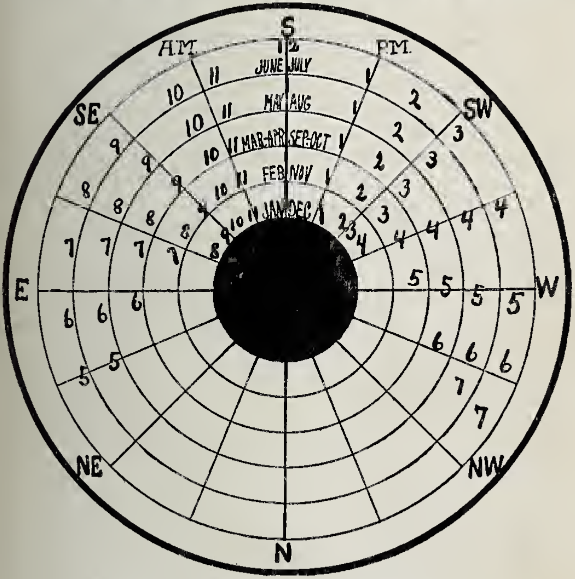


Figure 8. Device for finding the best time of year and day for illumination from any desired direction.

also in comparatively sharp focus. These objects are all within what is called the "field of definition" of the lens. The distance from the nearest to the farthest object in comparatively sharp focus is the "depth of field" or "depth of definition" or "depth of focus." The shorter focus the lens employed and the smaller the stop the greater is the depth of field. The range of good definition is greater beyond the point accurately focused than in front of it.

Limiting the Definition

With these facts in mind it is possible to limit the definition in our picture to any portion thereof that we desire and, by throwing the rest into diffusion, subdue it in any degree from a slight softening to an absolute blur. If our picture centers in the foreground we shall focus comparatively closely and soften the middle distance and background. If our chief interest lies in the middle distance we shall slur over the foreground, if it is uninteresting, focus sharply at the chief objects and leave the background also to diffusion.

Using a Table

A table of what is known as "hyperfocal distances" is presented below for most of the common stops and for lenses of different focal length. When sharp focus is secured on infinity, all objects at the hyperfocal distance and beyond are in good focus. If sharp focus is secured on the hyperfocal distance, then, with the stop indicated, all objects are in focus from half that distance up to infinity. Moreover, by the use of a simple formula and this table, it is possible to compute, for any stop and any distance sharply focused, the nearest and farthest points in good focus. For the nearest distance, multiply the distance focused by the hyperfocal distance and divide by the sum of the two; for the farthest, multiply as before and divide the product by the difference between the hyperfocal distance and the distance focused. For those who possess cameras with focusing-scales and without a ground-glass, the construction of a table including these nearest and farthest distances for each stop and each point on the focusing-scale will be found extremely handy for outdoor use.

TABLE OF HYPERFOCAL DISTANCES

Focal length of Lens in inches	Ratio marked on Stops									
	f/4 U.S.1	f/5.6 U.S.2	f/6	f/7	f/8 U.S.4	f/11 U.S. 8	f/16 U.S. 16	f/22	f/32 U.S. 32	f/64
	Hyperfocal distances									
4	33	24	22	19	17	12	8	6	4	2
4¼	38	27	25	21	19	14	10	7	5	2½
4½	42	30	28	24	21	15	11	7½	5½	3
4¾	47	34	31	27	24	17	12	8½	6	3
5	52	36	35	30	26	19	13	9½	6½	3½
5¼	57	40	38	33	28	21	14	10½	7	3½
5½	63	45	43	36	31	23	15	11½	7½	4
5¾	68	50	46	38	34	25	17	13	8½	4
6	75	54	50	42	38	28	19	14	9	4½
6¼	81	58	54	46	40	29	20	15	10	5
6½	87	62	58	50	44	32	22	16	11	5½
6¾	94	67	63	54	47	34	24	17	12	6
7	101	72	68	58	51	37	25	18	12½	6
7¼	109	78	73	62	54	39	27	20	13½	6½
7½	117	83	78	64	58	42	29	21	14½	7
7¾	124	90	83	71	62	45	31	22	15½	7½
8	132	96	88	76	68	48	32	24	16	8
8¼	141	100	94	80	71	51	35	25	17½	8½
8½	150	104	100	84	76	56	38	27	19	9
8¾	156	111	104	89	73	57	39	29	20	10
9	168	120	112	96	84	61	42	31	21	10½
9¼	180	127	116	101	90	65	45	32	22	11
9½	190	133	125	107	95	68	47	34	24	12
9¾	198	141	131	113	99	72	50	36	25	12½
10	208	148	140	120	104	75	52	38	26	13

One more thing, choosing the proper time of day may bring an object into the shadow which cannot otherwise be obliterated.

Sky and Ray-Filter

The more or less dirty gray space that does service as sky in many photographic prints is often the despair of the pictorialist, and the substitution for it of something better is not too easy. Its explanation is based on the high actinic power of the blue sky which underlies the clouds. This impresses itself so rapidly on the negative that it makes as dense a deposit there as the white clouds themselves, and hence any demarcation between them disappears. It is evident that any means which can be taken to decrease or neutralize the actinic power of the blue will give the clouds a chance, and such a means is the ray-filter, which will be discussed in its other applications later in this monograph. There is a particular form of the ray-filter made with the upper half yellow grading into clear glass beneath, which holds back only the sky and permits a normal exposure on the landscape below. But the ordinary ray-filter is usually of much value, especially where the landscape conditions themselves indicate the need of chromatic correction, as in a coast scene, with a brilliantly blue sky filled with white clouds.

Printing in a Sky

Combination printing, in which the landscape negative is supplemented as to its sky-space by the use of a sky from another negative taken for that particular purpose, is effective. The chief difficulty is securing a correspondence of the lines in one negative with those in the other. Another warning, do not employ a "favorite sky" in too many landscape pictures. The use of pieces of cotton-wool affixed to the negative to stimulate clouds is too crass and careless a method to deserve any recognition from a serious artist. Perhaps simpler than combining negatives in printing is the taking of two negatives in immediate succession of the scene which is pictured. The first of these may be exposed normally on the landscape; the second, much more briefly for the sky. If the camera is not moved between exposures, the negatives are subsequently bound together in register, much like a lantern-slide and its guard-plate, and printed from in this shape. In all cases where sky and landscape are from separate negatives, care must be taken that they harmonize, e. g., that the wind-driven clouds in the sky are proceeding in the same direction as the boughs of trees indicate the air is moving, and that both clouds and landscape are lighted from the same angle.

The Use of Figures

Whether figures shall be used or not in the lansdcape depends upon many considerations. In their behalf may be mentioned these arguments: they increase the range of emotions that may be expressed; they help to accentuate important features; often they afford the vertical or diagonal line that is needed in the presence of too many horizontals; if our purpose is genre as much as landscape, dependence for telling our "story" must be placed upon them. Against the use of figures are the facts that they are difficult to harmonize with a landscape as regards form and pose, expression and costume, and that many such emotional qualities as wildness and ruggedness are lost in their presence without the most careful treatment. The first question to be decided every time is whether the landscape or the figure can be made the more interesting. Our law of special prominence tells us that two items in a picture cannot be equally important, and we must decide between them. In the one case, we shall have next to decide how the figure may develop the landscape; in the other, how the landscape may best support the figure. To the former instance one axiom conventionally applies, that the figure shall be not larger in its longest dimension than a sixth part of the diagonal of the whole picture. Finally, every figure must seem to have room to move about. It must be possible for the bending person to rise without hitting the top of the picture.

Several Figures

The idyllic pictures of Corot are among the few exceptions to the rule that, if there is a group of figures, it must be the dominant thing in the picture. With one figure the rule is to use it as the dominant item and place it with reference to the general laws of composition. With two figures, the difficulty increases. Either in interest or pose or indicated action, one has usually to dominate the other or there is a scattering of effect. Regarding three figures, Poore points out that two may be united by overlapping to present one mass (Fig. 9); or these two, though bodily separated, may be joined by other items and thus still oppose the third, or that all three may be related directly or by suggestion in a triangular arrangement. The same principles apply to groups of more than three figures. These are easiest handled by breaking them up into smaller groups, considering each smaller group a unit and arranging them accordingly. Hogarth's line (Fig. 1, I) may be appropriately followed in many group arrangements. It is necessary in groups that there shall be some one figure or subgroup dominant, and this is to be achieved by color, light effect or position in the picture space.

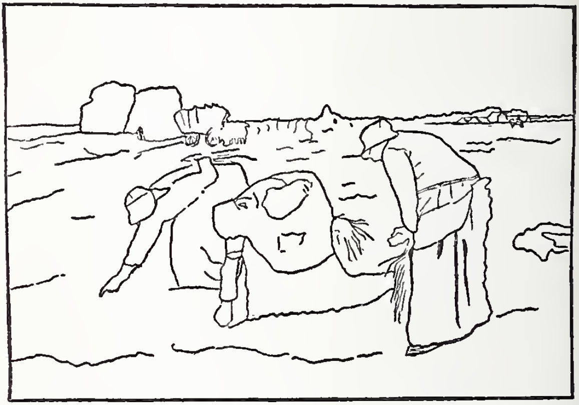


FIGURE 9. "The Gleaners": Millet. One type of three figure arrangement.

The Use of a Preliminary Sketch

No matter how roughly you do it, working out the composition beforehand on paper, where figure compositions are concerned, will be found of great assistance. Remember the angle of the general line of the figure and the relation it will bear to other lines in the picture. The point of interest of the picture generally is within this line of the figure; it may be the line as a whole. This line, moreover, should dominate the subordinate lines of the picture, either by contrast, balance or accent. Notice again, for instance, the dominating vertical line of the figures of mother and son in the "Hagar and Ishmael." As a mass, the figure, or combination of figures, must also receive attention in this preliminary draft and subsequently. The attractive force of any spot in a picture space depends upon its position, its size and, in chiaroscuro, its intensity of light or shade. As a general thing, a light spot draws the attention more forcibly than a dark one, but much depends upon the other tones in the picture. If the figure is dominant and light, it must be the highest light in the picture. This effect is to be achieved both by the clothing worn and by the illumination. If the light-focus chiaroscuro form (Fig. 2) is followed where a group of figures is used, those figures in light clothing should be brought nearest to the point of compositional focus, the others taking their places toward the sides.

Emphasis by Isolation

The use of isolation as a means of giving dominance to the figure must not be carried too far. We cannot put our figure in one half of the space and our landscape in the other and have an artistic picture result. The principle of the steelyard (Fig. 1, II) is to be well remembered in this connection. The figure at one side of the vertical axis must find a balance in some item on the other side. If a feeling of openness in the landscape is sought, it is best secured, in those instances where the figures themselves are not dominant, by placing them near to the principal masses in the landscape. Thus they coalesce, so far as composition is concerned, with these masses and leave the remainder of the picture space open for whatever development we will. If they are on the other side of the picture from such masses, they must take the place of the small weight of the steelyard: they must be smaller and more distant from the axis of the picture than the dominant masses.

Groups

In working with groups of figures, both variety, simplicity and unity are to be sought. Simplicity will not be obtained, as in those pictures of picnic groups that we took in our earlier days, by turning the heads and eyes all in one direction, for thereby we kill all our chance at variety. The separation of the large group into smaller ones is the simplest prophylactic against this fault. For the sake of unity there will not be too much scattering in the actions or aspect of the members of the general group. In genre groups especially it is permissable that some of the figures have their backs full or three-quarters presented to the camera if arrangement and idea are thus best served.

Models No task on earth requires more patience, perseverance, or tact than the finding and training of models for photographic work. If we select a friend he is more interested in our work and more anxious to help than a stranger, but his lack of experience makes him inferior to the trained professional. The ordinary person, put before a camera, neither knows how to stand nor how to look. Before posing he may have been the most graceful person in the neighborhood, but in the new situation he immediately becomes self-conscious, awkward, stiff, and, so far as expression is concerned, apparently never possessed of an idea in his life.

As a general rule, the professional model who has posed for photographer or painter is the best material to secure. Where a less experienced person is employed, he must be taught first of all not to look at the camera, not to remember himself, and not to inject his own ideas into the picture. Equally must he guard against over-zealousness, especially if he is one of a group, but, like an actor in a play, suppress his own personality for the benefit of the whole conception. Much stiffness may sometimes be avoided by pretending at the moment of exposure that the picture, because something has been forgotten or for another reason, cannot be taken. The subjects will more than likely fall out of their constrained attitudes, and the exposure may then at once be made. The man with one model is apt to produce as monotonous work as the man with a "favorite sky," and variations in costume and setting, in style of treatment and theme, must be sought until a new model is secured. Better still, if you are situated near an art center of importance where professional models are numerous, do as many a painter does: conceive your subject first and then seek the model you need for it. In this day of the esthetic dance cult, the students of schools thereof often are available and, sometimes, capable models.

Methods and Technique

Devotees of other arts than photography have long been wont to maintain that it is not an art at all because perfect control of his means of expression is not afforded the photographer. The mechanical nature of the photographer's work in certain stages will always to some extent support their claim, but is supporting it to a slighter extent every moment. More and more photographic technique is so developed as to make individual expression possible. From the very altering of the focusing mechanism of the lens, through the development and after-treatment of the negative, to the work that is possible on prints, the photographer may now progress surely and steadily toward a predetermined object. That, I take it, is the technical side of the painter's pride as well, but he no longer shares it alone. The one prerequisite which, from the photographer's standpoint, has been developed only in the work of leading photographic artists of the last two decades, is a definite conception from the outset of what it is the pictorialist is trying to do. Confusion, blundering, and failure only can attend the lack of such an objective; definite procedure toward the desired object is mapped out for him who possesses it. This technical side of landscape picturing will be the subject matter of the next several pages.

The Camera

About the camera which the landscapist shall employ it is necessary to say but little. He will work with the best camera he can afford, and cameras now are so carefully scaled with price parallel to quality that he will likely get what he pays for. As to the size of camera to be employed, much will depend upon the photographer's own taste. In the employment of such printing processes as platinum and carbon, the possession of a plate as large as it is desired the finished print shall be is an obvious advantage; the preliminary bother is lost of making an enlarged negative. The larger size plates, at least 6½ x 8½ or 8 x 10 inches, are here an advantage. The question of cumbersomeness and weight must be considered, on the other hand, for an 8 x 10 camera with its tripod and carrier of plateholders and plates will prove no small burden at the end of a long day's tramp. The same consideration enters into the choice between films and negatives, but no other. The superiority of plates as regards subsequent work is too manifest to need discussion. Except for the larger-sized cameras, the carrying of a bulky tripod is usually a gratuitous insult to one's shoulder muscles, for the lighter forms, providing a certain degree of rigidity is assured, are plentifully strong for the short exposures usually required out-of-doors. A rising and falling back equipment on the camera, as well as the swing-back, if buildings of any dimension are included in one's ordinary work, are facilities of considerable value. The lens-hood to fit over the lens where the light comes to any degree from the front ought always to be provided. It can be made with but little ingenuity out of matt black paper or other material readily available. See The Photo-Miniature, No. 158, Photographic Apparatus.

Lenses for Landscape

Of more importance than the camera and its other attachments is the matter of the lens. First, as to the angle of view. The eye commands a view of some 60 degrees, and we are so accustomed to this angle that the perspective furnished by a lens of considerably greater or less angle appears distorted. With regard to the length of focus, readers will remember that the shorter the focus the greater the depth of field. On the other hand, the greater the focal length the larger the image will appear, though this advantage disappears with enlargement as simple a matter as it is now made for us. Securing diffusion of focus over a considerable part of the picture space with the sharpness localized to those parts where emphasis is desired is, perhaps, also more easily acquired with the longer focal length.

Some Differences

The single lens has been well renamed the "landscape" lens for, in landscape use, the demerits it possesses of slow speed and distortion disappear in the face of the extremely brilliant image it affords. Let its possessor, then, not despair, and let the person who proposes buying an expensive anastigmat hesitate before the alternative of a set of single lenses of varying focal lengths before he finally decides. The all-round serviceableness of the rapid rectilinear commends it for landscape work also, and its slower speed is not, in landscape work, a disadvantage. The anastigmat does afford the most wonderful definition, even at large apertures, but many will question whether such extreme sharpness is always or ever necessary in landscape work, or whether the covering power of the anastigmat does not also cease in outdoor work to be so considerable an advantage.

Color-Filters

One portion of the camera's equipment which must not be omitted is the ray-filter or color-screen, the function of which is to hold back the highly actinic blue and violet tones in the landscape so that they do not assume too great density in the negative in comparison with the others. It is their facility in this regard that is chiefly destructive to the quality of tone which was mentioned earlier in this monograph. In a landscape where yellows and greens dominate, the use of the screen is especially indicated. These screens range from what are called "two times" up to "fifteen times," according to the density of their yellow, the figure referring to the factor by which a normal exposure must be multiplied. For general work, screens from five times to ten times will be found most advantageous. Too dark a screen will make the yellows and greens too light in the print, the blues and violets too dark. In cloud work, however, with the more delicate cloud forms, such as the cirrus, a rather deep screen should be used. The "sky-filter," which is graded from yellow above to clear glass below, is here often advantageous. The effect of a screen is more evident in brilliant than in flat lighting. There is a valuable chapter on this whole subject in Mees' "Photography of Colored Objects."

Exposure for Pictorial Effect

When one has mastered the primary considerations of exposure—and there is no surer way to a firm footing in this regard than by a study of THE PHOTO-MINIATURE, No.

105 on "Correct Exposure"—he will begin to consider modifications thereof to get the effects he desires. This will depend on what tones in the landscape he particularly seeks to emphasize and how deep he wants these tones to be. Hence, the older rule of exposing for the shadows and letting the highlights take care of themselves may be distinctly tempered by the considerations of whether he wants little or much detail in the shadows and whether he wants the highlights bright or dulled. It all comes back to the question of the artist's own concept of the landscape—what the landscape really says to him. If it is brightness and joy and the lighter emotions generally that he wishes to express, he will give a briefer exposure than ordinarily; if somberness and quietude are in the soul of things, the exposure will be somewhat extended.

Suggestions

Here, too, are several exposure hints that are worth remembering: Though an extended exposure is needed under trees, flatness will result from too much time. For the same reason, under rather than over-exposure is needed on cloudy or foggy days and toward evening. With the lens toward the sun—here is where the lens-shade is needed—remember that the shadow side of most objects is presented and that the exposure must consequently be lengthened. The difficulties of distant mountain lines against the sky are avoided by the use of the color-screen; of naked tree boughs similarly backed, by full exposure; of small branches and twigs being lost in a similar situation, by orthochromatic plates backed so as to avoid halation, and by plentiful exposure, but not excessive.

Modifying the Negative

Primarily, control in development is based upon the fact that the more prolonged the development, up to a certain point, the greater is the contrast. This increase in contrast is more apparent when the exposure has been undertimed. The best medium for flat subjects, be it noticed, is slow plates, and where softness is desired, fast plates, rather than alteration in the length of development. The first subsequent treatment, if any is desired, may be either intensification or reduction, and these characteristics of the several reagents are to be remembered: Use the mercury and ferrous oxalate intensifier to build up all the tones evenly in negatives which are bright but thin from brief development; mercury and ammonia, to build up the shadows, principally in thin and flat negatives resulting from too prolonged exposure; Monckhoven's, for the latter purpose to a greater degree; Farmer's reducer, to lessen depth in the shadows without affecting the highlights in negatives too hard from short exposure and long development; ammonium persulphate, for reducing the highlights but not the shadows in too dense and flat negatives from long exposure and long development; Farmer's reducer first to a slight extent and then an intensifier, to secure more contrast in negatives that are flat though not too dense. Either Farmer's or ammonium persulphate is available for local, as well as general, reduction.

Another method of local reduction is by rubbing down the portions desired thinner with chamois skin moistened with alcohol. Space is not afforded here for a general consideration of retouching landscape negatives, but the use of the pencil on negatives which have been treated with retouching medium will be good practice for even the untutored. Make a copy of the un-retouched print first as a guide. Then try entering detail in shadows that are too flat; highlights in tree trunks and boughs and even amidst the foliage; corrections of blurs in leafy foliage from either halation or movement in the wind; reducing accents that appear too strong and soon.

Printing Methods

The choice of the printing medium is something no pictorialist will arrive at except by experience. Nine out of ten will work with gaslight papers for contact printing and bromide for enlargements and get good results at that. The wonderful gradations, the rich shadows and the transparent highlights will attract others to platinum and carbon. The almost complete control afforded by oil and bromoil and the picturesque effects of gum will win more advanced workers to these media. Bromide paper is probably the simplest of all to handle, not only from the ease of working with it but because of the readily made enlargements by its employment. Larger prints than the negatives in carbon and platinum will necessitate the making of enlarged negatives. Bromide enlarging affords various simple methods of control, such as alterations of the focus and the interposition of chiffon, bolting cloth, or other diffusing substance between lens and paper. Other workers have tried with success the plan of making a contact positive from the negative in a printing-frame and photographing this in turn through a single, soft-focus lens at wide aperture. Considerable control, with surety gained by continued experimenting, is achieved by glueing to the glass side of the negative fine-grained tracing-paper previously dampened. When this has dried it will have stretched absolutely taut against the glass. It may be worked upon with a very soft pencil or with pencil filings and stomp to emphasize the high-lights, or Canada balsam may be applied to it over those portions of the negative which are desired to print darker. "Sunning down," that is, exposing the print before development or toning to the printing light—artificial or sun—is a simple means of reducing too great contrast between lights and shades, but it must be judiciously employed.

Trimming

The principle of sacrifice, which it was sought to emphasize earlier in this paper, need not be forgotten when it comes to finishing the print. Sacrifice everything therein by trimming what is not absolutely necessary to the picture. Go over the print with two large L-shaped cards which will permit it to be viewed with various parts excised and in rectangles of various shapes. When the right outline is found, with the picture reduced to one thought and all non-necessities eliminated, trim at that point. Making the top and bottom parallel to the horizon and the side to the vertical lines is, naturally, the first step.

Mounting

In the matter of mounting it is to be noted that more margin in the mount may be allowed proportionately for small prints than large; that the print ought never to be in the geometrical center of the mount; that the margins above and at the sides may equal each other in upright prints with a wider space below, but, with horizontal prints, the side and lower margins should be equal and the top margin less, with some exceptions; that in very extended horizontal prints the top margin should exceed the sides in proportion to this extension; that a wide lower margin accentuates the foreground, and wide side margins appear to extend the horizontal lines. The effect of the general tone of the mount is the same as that of the half-tone in the print itself, a light mount making a print appear darker and vice versa. An extremely light or extremely dark print is best offset by a still lighter or darker mount respectively. If the print is already properly mounted, there is no need of a frame to afford this support all over again, nor of a mount if the picture is properly framed; mount and frame are tautological. All this is well considered in THE PHOTO-MINIATURE No. 102: "Trimming, Mounting and Framing."

Size of a Print

Whether a certain picture will look best in a print the size of a quarter-plate or ought to be shown in an enlargement to 2 x 3 feet, or to some point between, is to be decided by several considerations. Definition ought to be retained in a small print, which will ordinarily be viewed close up where diffusion would be objectionable, while the latter quality may better dictate a large print. The more profound the emotion expressed the larger, as a rule, the print ought to be. It is difficult to give an impression of wonder or reverence, majesty or awe, in a tiny print. From the technical standpoint it is well to remember that flaws of any sort in the original are the more evident the greater the enlargement.

A Few Don'ts

Our survey of the whole subject of landscape photography has suggested various principles which may be summarized here in some such series of "don'ts" as the following: Don't photograph any landscape until you have clearly in mind what the landscape means to you and what you want the finished picture to say. Don't photograph what attracts merely by extent, color, or illumination. Don't say more than one thing in one picture. Don't permit subsidiary objects or lines to detract from the dominant ones or approach them in force. Don't put the vital part of your picture at the center. Don't run the horizon line across the dead horizontal center of the picture. Don't leave the dominant object on one side of the vertical center line unbalanced by something else on the other side. Don't have the main lines running all in one direction. Don't forget that shadows are needed to make the picture as well as light, but that neither ought to be so chopped up as to appear spotty. Don't neglect detail unless it threatens simplicity and unity. Don't forget that all rules, in art as elsewhere, are made to be broken when the occasion demands. Don't let roads and paths or other moving masses lead into the picture from the lower edge. Don't be content with the lighting at a certain time if another day and hour will afford illumination at a better angle. Don't be content with a patch of dirty gray for a sky. Don't use figures in the landscape if the landscape will express your idea without them. Don't let landscape and figure exist in the same picture unless they are unified by idea and arrangement and unless one or the other dominates. Don't suppose that a "straight print from an un-retouched negative" is anything to brag about unless it is exactly what you wanted. Above all, don't suppose that merely copying Nature is producing artistic work, or that Nature is art, or that it ever can become art, except by its interpretation through the mind of the artist and the presentation of this interpretation with the greatest technical skill that his medium of expression affords.

The general appeal of the landscape picture makes its subsequent placement a matter of wide choice. It may adorn the walls of the home or contest for prizes in the photographic salon. It serves well for souvenirs and for a higher type of picture postcard than the average. Commercially, it is available for reproductions for its own beauty, for pictorial calendars and in numerous other ways. The Photo-Miniature No. 120, "Marketing Photographs for Publications," lists a hundred magazine offices where such pictures are in demand. The mutual service which photographers may render each other by contributing of their best to photographic publications ought never to be overlooked. The pleasure which the public may take in our work is enhanced manifold by the technical interest which our fellow workmen will find therein.

ROY HARRISON DANFORTH.

BOOKS ON LANDSCAPE PHOTOGRAPHY

"Pictorial Composition." By Henry R. Poore. $2.

"Pictorial Landscape Photography." By John A. Hodges. 25 cents.

"Pictorial Landscape Photography." By Paul L. Anderson. $1.50.

"Practical Landscape Photography." By G. T. Harris. 60 cents.

Notes and Comment

With very great personal regret I note the death of Mr. John A. Anderson, of Lambertville, N. J., which took place March 18. Mr. Anderson was a veteran journalist but had for many years retired from business, and photography was the chief hobby of his later years. He was an enthusiastic amateur and was particularly interested in the mathematical side of photographic optics. Some years ago he offered for publication in THE PHOTO-MINIATURE a collection of valuable notes and tables dealing with the question of focusing the photographic image. Unfortunately, the contribution was somewhat abstruse and too advanced for publication in these pages, but I have always regretted that it was not published and so made available for the helping of the few who are interested in this detail of photographic practice. He was a most appreciative supporter of my work in THE PHOTO-MINIATURE and a good friend. May the earth rest lightly upon him.

The development of aviation for the purposes of the Great War has brought forward many ingenious inventions for the use of the camera in connection with the aëroplane. In America we have the Multiple Aëroplane camera of Herbert & Huesgen. This is constructed entirely of metal, measuring 8½ x 4½ x 2½ inches, with a weight of six pounds. It uses the standard perforated motion-picture negative film in 50 feet lengths with a capacity of from 1 to 750 exposures at one loading. It has a lens working at *f*/4.8 and focal length of 4¾ inches, for use at altitudes from 500 to 10,000 feet. In action, one pull of a flexible cable winds up the previous exposure, sets the shutter, makes the exposure and registers the number of the photograph taken. The return of the handgrip to its normal position makes the instrument instantly available for the next photograph; one second completes the cycle of operations required to make an exposure. Mr. William F. Folmer, of the Eastman Kodak Company, has also perfected an aëroplane camera which is already in successful use at the naval stations on our coasts. This is described as a box, 2 feet long, carrying a pistol grip, gunsight and trigger which, when in use, is pitched most of the time at an angle of 45 degrees. This slant is said to give the camera a wider sweep and to make it more valuable in practical use than cameras adjusted to the bottom of the plane. It weighs about fifteen pounds and is suspended from the shoulders of the operator, being fitted with a Graflex focal-plane shutter capable of successful photographs even if the aëroplane could travel at the impossible speed of 300 miles an hour in the air. Some of the pictures made with this shutter are said to have been given an exposure of 1/295th of a second. A further interesting note about the cameras found on German aëroplanes and dirigibles is translanted from the *Rivista Artigliera* in the *Amateur Photographer* of March 26. Apparently these cameras are fitted for plates and carry color-screens. The lenses are Zeiss Tessars, usually working at *f*/3.5 with a shutter working from 1/50th to 1/800th of a second.

The Pictorial Photographers of America is the name of an organization recently formed, with headquarters in New York, made up of well-known men and women who have pledged themselves to a campaign which will place photography on the highest possible plane. Clarence H. White is the president, Dr. A. D. Chaffee and Gertrude Kasebier, vice-presidents, with Edward R. Dickson as secretary and Dr. Chas. H. Jaeger as treasurer. The annual fee is $5, and the organization makes its home at the National Arts Club, 119 East Nineteenth Street, New York City. Among the objects of the pictorial photographers is the formation of exhibition centers where collections of artistic photographs may be seen and purchased by the public; to enlist the aid of museums and public libraries in adding photographic prints to their departments; to invite exhibits of foreign work and encourage the participation by Americans in foreign exhibitions of photography. Anyone interested in photography and in sympathy with the aims of the organization is eligible for membership, whether an active worker or not.

A few days ago I spent a very pleasant half-hour with Mr. H. L. Ide, of Springfield, Ill., an inventor who has given particular attention to the mechanical side of photography for the helping of the amateur. A recent invention of Mr. Ide's is a device, permanently attached to a Kodak (or, I presume, any other roll-film camera), which provides a means of ascertaining the correct exposure for any scene or object. An actinometer disc with sensitive paper is recessed at the end of a spool-chamber. This gives a factor or number which is applied on a small sliding scale let into the top of the camera and which instantly gives the exposure required with any of the stops fitted to the lens in use. The invention struck me as being altogether practical and exceedingly simple in its operation, with all the advantages of the actinometer method of ascertaining exposure.

I am asked to advise the retirement of Mr. F. Ernest Cramer from the G. Cramer Dry Plate Co., of St. Louis. This retirement will apparently not interfere in any way with the business of the Company, the different departments of which will remain in the hands of Messrs. Emile R. Cramer, A. L. Milentz, and G. A. Cramer, who have been in charge for many years past.

Among the most popular features of the recent Photographers' Convention, at Philadelphia, was a lecture-demonstration of the "Commercial Applications of Color Photography" given by Henrietta Hudson, of New York. The demonstration aroused great enthusiasm, especially Mrs. Hudson's method of making autochrome duplicates for commercial use at a small cost. I hope to persuade Mrs. Hudson to give me the details of this method for publication in a later issue.

The Fourteenth Salon of the Toronto Camera Club is announced to be held in the Art Museum of Toronto, Canada, May 2–16. Several gold and silver medals are offered in the landscape, marine, genre, portrait, novice, and miscellaneous classes. The exhibitions of the Toronto Camera Club have always been notable for the quality of the work they have brought forward, and those readers who are making holiday in May would do well to include a trip to Toronto to see the Exhibition.

A very interesting handbook to the Cirkut method of making photographic panoramas has just been issued by the Folmer & Schwing Division of the Eastman Kodak Co., Rochester, N. Y., the booklet is profusely illustrated and contains full instructions for the use of the Cirkut camera. Copies can be obtained on request.

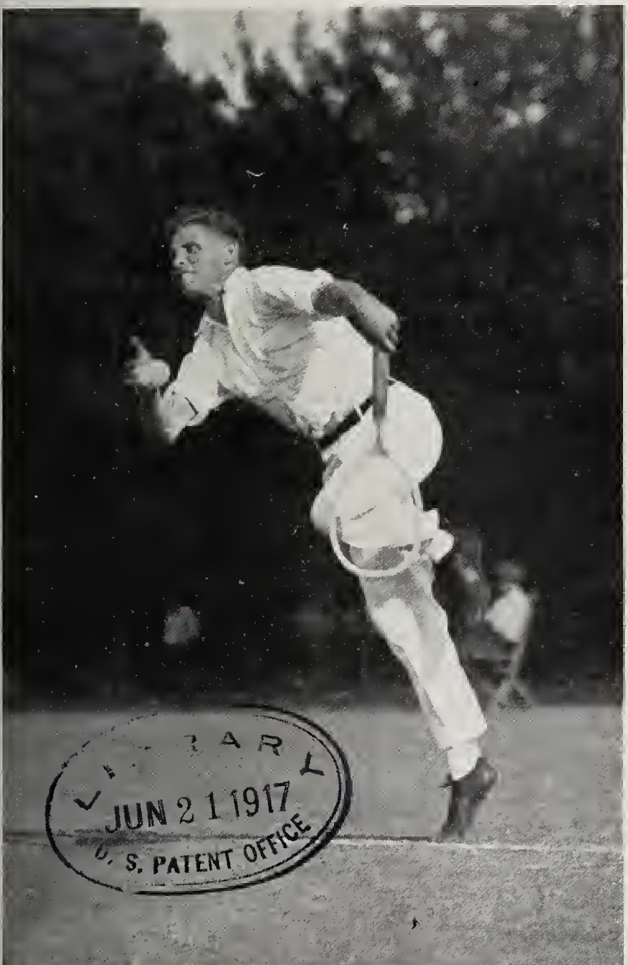
A notable difference between the conduct of the photographic supply business in this country and Great Britain is that most of the larger dealers of Britain do a very big mail-order business, selling from their catalogues. This difference is rapidly disappearing, and we have several American photographic houses engaged in the mail-order business. Perhaps the largest of these is the house of David Stern Co., who have been in business since 1885 and are now located at 316 Davsco Building, 1047 Madison Street, Chicago. The catalogue, "Cameras, Lenses—Motion Picture and Photographic Accessories," issued by this firm is a most persuasive bit of literature and well worth sending for.

An exhibition of gum prints loaned by Mr. Elias Goldensky was the principal feature of the work of the Columbia Photographic Society, of Philadelphia, during March. Philadelphia readers desiring to affiliate with this enterprising society should communicate with the Secretary, Mr. C. F. Davis, 2526 North Broad Street, Philadelphia, Pa.

"Photograms of the Year 1916" has at last made its appearance in London, and we are advised that the American edition will be on the high seas by the time this word meets the reader's eye. If the book escapes the submarines and other perils of the sea, it should be on sale in America about the middle of April. As the American edition is limited and it will be impracticable to import a second shipment, those desiring copies should enter their order with the nearest dealer at once and so make sure of a copy.

The publishers of "The Penrose Process Yearbook" (Penrose's Pictorial Annual, 1917) have announced that the publication of this Yearbook for 1917 has been postponed until a more favorable time—presumably nearer the end of the year. This book is still in the making and will be completed, but apparently its publication cannot be looked for until after the summer is over.

A new Kodak is announced, the 2C Kodak Jr., a thin, slim camera, giving pictures 2⅞ x 4⅞. It is priced at $12.



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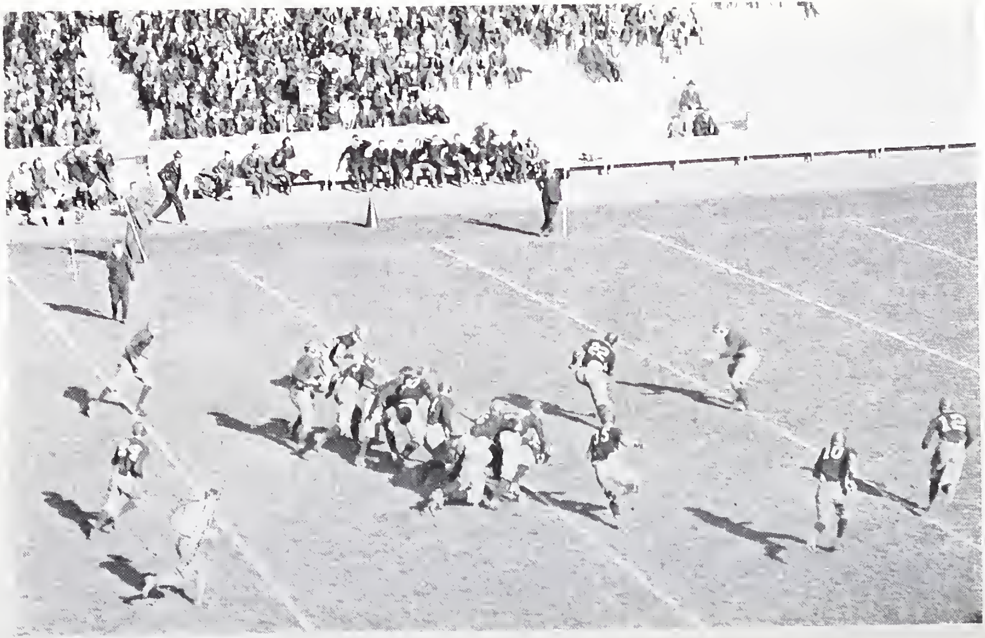
Tennis—R. Lindley Murray in a characteristic action-pose
Photo Edwin Levick, New York



Football—a critical point in the game

Sweethearts and wives cheering their men on manœuvers with the power-boat squadron
Photo Edwin Levick, New York

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Skating offers attractive opportunities for interesting figure pictures

Photo Edwin Levick, New York

Mills winning the American championship —100 yards—at Newark
Photo Edwin Levick, New York

The Finish of the Snow Shoe Race

Travers making a beautiful Put—Golf
Photo Edwin Levick, New York

"This is the Life"

The Photo-Miniature

A Magazine of Photographic Information

EDITED BY JOHN A. TENNANT

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Sports and the Camera

The Century Dictionary defines sport as any sort of outdoor play, game, or diversion. I am careful to put this definition in the forefront of this little book, because in its preparation I encountered a man who stoutly averred that "Sports and the Camera" did not properly inform him of the possible contents of a book so entitled. But for this man and his interference, this first page would have been devoted to a recital of the universal instinct for and love of outdoor sports among the men and women and children of the world since the world began. Since, however, I must particularize, let me set forth in sober fact that the purpose of this number of The Photo-Miniature is to tell the reader something about the many interesting uses of the camera in getting records or pictures of the world at play out-of-doors, and that when our modern world plays out-of-doors, its activities may be briefly summed up under such sports as baseball, football, cricket, tennis, golf, boating, swimming, diving, sailing, horse-racing, foot-racing, yachting, cycling, canoeing, jumping, lacrosse, hockey, water polo, hunting, vaulting, curling, skiing, skating, and shooting.

A Vital Difference

The difference between the photography of sports and the everyday photography with which we are familiar lies plainly in the fact that our sports express life in action, with lively or rapid movement as its essential feature, whereas when we photograph the neighbor, or his wife, or his house or lands, or his ox or automobile, or the things of interest or beauty with which the world is filled, we usually picture them at rest, without lively movement or action. And it is, in truth, a vitally different thing to make a good photograph of any object in motion, compared with the photographing of objects which, for the moment at least, are still and motionless. The last permits of composition and arrangement, the other means the recording of one of a thousand movements or phases of activity, and the record must be made in less time than the twinkling of an eye.

Speed Calls for Speed

Take the case of golf, a sport which offers many interesting possibilities for the camera. They tell us that when the little ball is driven from the tee it travels at the rate of over 200 feet per second. Similarly, in such games as football and cricket, a man will move at the rate of 10 feet a second; a college eight on the river, going at its best, will move at the rate of 20 feet per second; and a speedy trotting horse at more than 40 feet per second. Considering these figures, which approximately express the action we seek to record in our photographs, and connotating the movement of the picture image on the plate and our shutter speeds in fractions of inches and seconds respectively, it is obvious that photographing outdoor sports involves some new and undreamt of problems. It is, in fact, a sport in itself, as full of fun, zest, and excitement as any other outdoor play, game, or diversion yet invented.

Wherein is Success

Success in this field depends, of course, very largely on the man behind the camera, upon his knowledge of the sports he seeks to record, and upon his skill and resourcefulness in technical photography. The photograph is, as we know, the result of light-action on a light-sensitive medium—plate, film, and paper. In everyday photography, without movement in the subject, we can calculate the amount of light-action required and make our exposures accordingly. But in photographing sports, where motion is to be recorded, it is all a matter of speed. We work on the edges of our capacities at every turn, the problem of securing a record of the subject in motion depending on whether the plate is sufficiently sensitive, the exposure shutter sufficiently efficient in its movement, and the lens sufficiently rapid or efficient in its intensity, to permit the amount of light-action needed in the exposure period to give a picture image sufficiently dense to yield a print, while recording the action of the subject without blur or confusion. Fortunately, the problem is not so difficult in practice as in theory, and by combining a fair knowledge of sports, photographic technique and the factors peculiar to the photography of objects including movement, the average amateur will quickly find himself sufficiently expert in sport photography to get both pleasure and profit out of the use of the camera in this field.

Apparatus

The detail of apparatus need not give us much trouble here. For accuracy, efficiency, and general satisfaction the reflecting-mirror camera (Graflex) fitted with a focal-plane shutter and a lens working at *f*/6.8 is the ideal equipment. This outfit eliminates 90 per cent of the possible chances of failure and means a larger percentage of successful pictures than is humanly possible with any other sort of equipment. But thoroughly good sport pictures can be made with the ordinary hand camera, especially if this is equipped with a lens working at *f*/6.8, a good lens-shutter with actual speeds up to 1-300th second, and a full-size wire-frame direct-vision view-finder fixed vertically above the lens. Finally, even the low-priced hand and pocket camera, with its *f*/8 lens and shutter speeds limited to 1-100th second as the maximum, will give abundant fun and satisfaction with many sports if used at a fair distance from the subject in a good light. In short, use the camera you have, offsetting any practical limitations in its capacity by intelligent discrimination and modification of practice as may be needed.

Lenses: Plates: Films

A great deal of buncombe has been published concerning the necessity of the fastest lenses and the most rapid plates in sport photography. One of the most successful workers in this field assures me that a lens working at *f*/6.8 is sufficiently rapid for any requirement, and that he most frequently uses his at an aperture of *f*/8. As for plates, he advocates the use of a standard rapidity such as the Seed 26x, basing his preference for this comparatively slow plate on his experience, which backs up the theory recently discussed by no less an authority than Dr. C. E. Kenneth Mees, that the slower plate, with slight under-exposure, gives a better printing image than that yielded by the ultra-rapid plates receiving the same exposure. So far as film cameras are concerned, the standard roll-films of today are sufficiently rapid for any use required of them. Just what the individual worker gets out of any plate or film he uses, where under-exposure is feared, depends very largely on his method of development. In this detail we have the valuable help of Harvey (of exposure-meter fame) who tells us, as the result of countless experiments made during the last few months with every plate and film in the market, that the very best results are secured by using the developing formula and method given by the manufacturer in every box of plates or with every spool of film.

With these preliminaries disposed of, we can now take up the big problem of movement which stands at the forefront of all sport photography. If the reader will carefully digest what follows on this and exposure, he need have little fear of failure in tackling any of the sports thereafter dealt with in detail.

Size of Image

An important detail in all sport photography is the size of the image or, more precisely, the height of the principal figure or figures in the picture. This depends upon two factors: the focal length of the lens used and the distance away of the figures or moving object at the time of exposure.

The Bottom Fact

The natural desire is to get the principal figure or object of chief interest as large as possible. But the bottom fact to be remembered here is that the larger the size of the image of the principal object in relation to the picture space, the greater will be the apparent movement or displacement of the image on the plate or film during the period of exposure, and so much the more difficult will it be to get a successful picture, because of the risk of under-exposure on the one hand, or of blur and movement in the picture on the other.

The Average

Taking men and horses as the most common sport subject, Todd years ago examined some thousands of sport pictures and found that the best results are secured when the image of the chief object is about one inch or an inch and a half in height. This is the average size of the principal figure or moving object in most of the sport photographs of today. Where the figures exceed this average size, as in many reproductions of sport subjects in newspapers and magazines, the effect is usually secured by enlarging the figures in the photograph as originally made and trimming away the surroundings, or, more rarely, by the use of a lens of abnormal focal length in relation to the size of plate used—as to which see page 186.

So, in practice, the distance away from which the subject is photographed is generally determined by the size of the image desired and the focal length of the lens used. Where the choice of the working distance is beyond control, the remedy is to use a lens of sufficient focal length to give an image of the desired size.

Where only one lens is available, this should have a focal length one-fifth longer than the longest way of the plate in use, viz., 6 inches for a 3¼ x 4¼ plate, 9 inches for a 5 x 7 plate, and so on. To get an image 1½ inches high of a man or a horse, with a 6-inch lens, you must photograph the subject from a distance of 25 feet. But this means a very short exposure—probably beyond the capacity of most between-lens shutters. By contenting oneself with a ¾-inch image, however, you can work at twice this distance and increase the minimum exposure required to get a good photograph without risk of blur or movement. For example: we want to photograph the runners in a half-mile race and to get the figures 1½ inches in height. With a 7-inch lens at *f*/6.8, distance 30 feet, this would mean an exposure of 1-300th of a second, with the runners approaching at an angle of 45 degrees to the camera.

If a ¾-inch image will suffice, we can get an equally good picture at a distance of 60 feet, other conditions being equal, with an exposure of 1-200th second. From this it is obvious that the smaller the image the greater our chances of success, and that if we are limited to 1-300th second as our maximum shutter-speed, we should work at such a distance as will give figures under 1 inch in height if we want to be sure of fully exposed pictures without blur or movement. With enlarging methods as simple and effective as they are today, this device of securing sharply defined small images with full exposures by working from a fairly distant viewpoint is the easiest way to success.

Another Method

The alternative method, giving large images from a distant viewpoint by the use of a lens of abnormal focal length and small plates, with after-enlargement, is worthy of more attention than it has received. It was interestingly described and illustrated by John L. Wellington in *American Photography* a year or two ago. His equipment was a Graflex camera fitted with a Goerz anastigmat of 12 inches focal length, working at a speed of $f/6.8$. The pictures secured with this equipment were invariably enlarged three diameters for after-use. By this method an image of a man running, 1½ inches in height, was secured from a distance of 150 feet with an exposure of 1-200th second. From the same distance a 6-inch lens would give an image only ¼ inch in height, or, if a 1½-inch image were desired, the distance would have to be reduced to 25 feet and the exposure cut down to 1-330th second. The method has the disadvantage that where the exposures exceed 1-25th of a second, a tripod or other support for the camera is desirable to prevent oscillation or vibration during exposure.

Color in Exposure

Whatever the working distance, the factor of the color of the subject should not be overlooked in its bearing on the exposure. Thus, figures in white or light-colored clothing, such as is worn in tennis, boating, and many sports, may be secured at short range with brief exposures, where a large image is desired, whereas if the moving object is dark in color the exposure must be much increased if the viewpoint is within 50 feet of the subject.

Exposure Generallly

The problem of exposure in sport photography is necessarily more complicated than in everyday work with subjects not including movement. The essential condition is to "stop" or eliminate the movement of the subject during the exposure period, in other words, the exposure must be sufficiently short to give a sharply defined picture of the subject, without trace of blur or movement in the image itself, and yet sufficiently long to give a developable image or reasonably good negative. So the problem is always: How long an exposure can I give this subject, under existing conditions, so as to secure a perfectly sharp picture of reasonably good technical quality, without evidence of blur or movement during the exposure?

Governing Factors

The three essential factors governing exposures for subjects including movement are:

1. *The speed at which the object is moving*—ultimately the speed at which the image of the object moves on the plate or film. Obviously, the more rapid the movement of the subject, the greater will be the displacement (or movement of the outlines) of the image on the plate, and the shorter must be the exposure. For example: if the object photographed is moving at the rate of 9 miles an hour (158 inches per second) it will require just half the exposure needed to give a sharp image of an object moving at the rate of 4½ miles per hour (80 inches per second).

2. *The distance of the moving object away from the lens.*—The nearer the object is the shorter must be the exposure, simply because the nearer the object the larger will be its image on the plate and the more apparent its movement or displacement thereon. This is contrary to the rule governing exposure for near and distant objects *without* movement. Thus we have the rule: Knowing the exposure required for a moving object at any given distance, if the distance is halved, then halve the exposure; if the distance is doubled, then double the exposure.

3. *The focal length of the lens used.*—The greater the focal length of the lens used, the larger will be the image of the object on the plate, and the greater will be its apparent movement or displacement in a given time (e. g., the period of exposure). Hence long-focus lenses demand shorter exposures than those of short focal length. This factor comes into play only where the worker changes from one lens to another.

Modifying Factors

These, then, are the essential factors. There are modifying factors which we cannot afford to overlook, and which at times offer large advantage. These are:

Direction of Movement

The direction of the movement of the object influences its apparent speed and, consequently, modifies the exposure required. For example: the actual speed of an object, and the direction of its movement from a given point of observation, may call for an exposure beyond the capacity of the largest aperture of the lens carried in the camera. Exposure under such conditions would mean blurred images or under-exposed negatives. But if it is possible to change our point of observation, we thus change the direction of the movement of the object as far as the camera is concerned, and, at the same time, the apparent speed of the object is changed. Thus, when an object is moving directly across the field of view, at right angles to the axis of the lens (broadside on, as we say), the exposure is based on the actual speed of the object. But if we change our point of view, so that the object approaches or recedes at an angle of 60 degrees, then its apparent speed is one-half its actual speed and permits us to double the length of the exposure. This may bring the subject within the capacity of our lens. When the object directly approaches or recedes, say at an angle of 10 degrees, then its apparent speed is one-third or one-quarter the actual speed, and the exposure may be three or four times as long as that required for the broadside view.

Counter Movement

The apparent speed of an object may also be modified by the movement of the vehicle (such as a car or boat) from which we may be photographing. Here the apparent speed of the object increases or diminishes, according as its movement is in the opposite or in the same direction as that in which we are traveling. This plays an important part in photographing yacht races or sailing vessels from another boat moving parallel with the subject or in the opposite direction.

Movement of Parts

The movement of parts of the object, e. g., the legs of a horse, or the arms of a man rowing, as distinct from the movement of the object as a whole, may also modify the exposure. In such cases it is generally advised to expose for the most rapidly moving part, which often means shortening by one-half the exposure required for the movement of the object as a whole.

Dead Points

Finally, there is oftentimes practical advantage in using the period of suspended motion which forms part of all reciprocal movements. Thus, when a man or horse leaps over a high bar or fence, there is a momentary pause at the height of the leap, when he is no longer rising and has not yet begun to descend. Similarly, there is a "dead point" at the end of a stride in running, at the beginning of a stroke in rowing, and so on. To know these "dead points" and to be able to anticipate their position so as to utilize them in exposure often makes all the difference between success and failure.

Sharp Definition

A few words about definition will be helpful before we take up the use of these factors in calculating exposures. It is obviously impossible to produce an absolutely sharp picture image of a moving object since, no matter how infinitesimally short the exposure may be, the image will move on the plate during that time. Fortunately, "sharp definition" is a relative term, and we do not insist on microscopic definition in our photographs even when we have after-enlargement in mind. So, in practice, it is generally agreed that if the picture image is made up of points or discs not exceeding 1-100 of an inch in diameter, the photograph will be agreeably sharp as far as the average eye is concerned. This figure, by the way, is the familiar "disc" or "circle of confusion" so often mentioned by photographic writers in dealing with questions of focusing, enlarging, etc. Taking it as a basis of definition in focal-plane work, it is plain that to get a sharply defined image of a moving object we must find for our exposure that fraction of a second in which the image of the moving object will not move more than the allowable 1-100 of an inch on the plate or film. Furthermore, we must find the *longest exposure permissible* under this condition, for unless we can admit sufficient light to the plate during exposure to give us a developable image, all our labor will be in vain. Ultimately, then, we have to deal with the speed at which the image travels across the plate, and, for convenience in calculating, this speed is usually expressed in "inches per second."

Using the Factors

These things being understood, we can now consider the use of our factors in the actual calculation of exposures. It should first be explained that all calculations and tables are based on the most favorable conditions of light, etc., the most rapid plates, etc., and for objects moving at right angles to the lens, i. e., directly across the field of view. Other conditions call for modification along the lines already indicated.

The simplest method for calculating exposures in photographing moving objects or subjects including movement in parts is that given by Lawrence some years ago. It is as follows: Let **D** equal the distance between the object and the lens, expressed in inches; **S** equals the speed at which the object is traveling, expressed in inches per second; and **F** equals the focal length of the lens expressed in inches. Then

$$\mathbf{E}\text{ (exposure)} = \frac{\mathbf{D}}{\mathbf{S} \times 100\,\mathbf{F}}$$

To illustrate this let us take an example: We want to photograph an object (such as a skater or boat) traveling at the rate of 12 miles per hour (211 inches per second), at a distance of 50 feet (600 inches) with a lens of 6 inches focal length. Then:

D (distance) = 600 inches
S (speed) = 211 inches per second
F (focus) = 6 inches (multiplied by 100 in use)

and according to the formula:

$$\text{E (exposure)} = \frac{600}{211 \times 600} = \frac{1}{211}\text{ second}$$

With this simple formula Lawrence supplies a convenient table giving at a glance the number of inches per second equivalent to various rates of speed usually expressed in miles per hour, as follows:

Miles per hour equals	ins. per sec.	Miles per hour equals	ins. per sec.
1	18	18	317
2	36	20	352
3	53	25	440
4	70	30	528
5	88	35	616
6	106	40	704
7	123	45	792
8	141	50	880
9	158	55	968
10	176	60	1056
11	194	65	1144
12	211	70	1232
13	229	75	1320
14	246	80	1408
15	264	90	1584
16	282	100	1760
17	299		

A Short Cut When it is possible to work at a distance from the object equal to one hundred times the focal length of the lens used, then the "inches per second" figures in this table, considered as fractional parts of 1 second, may be used as the required exposure without need of further calculation—for normal conditions. For example: working at a distance of 50 feet from the object with a 6-inch lens, or at 42 feet distance with a 5-inch lens, or at 37 feet with a 4½-inch lens, and so on, the exposures would be 1-18th second for objects traveling at 1 mile per hour, or 1-100th second for objects at 6 miles per hour, or 1-175th second for objects going at 10 miles per hour.

Movement of Image To find the distance moved by the image of an object on the ground-glass, multiply the focus of the lens in inches by the distance in inches moved by the object in one second and divide the result by the distance of the object in inches. Example: Find the displacement of image on ground-glass of an object moving 20 miles an hour with a lens of 8½-inch focus and the object 450 feet distant.

$8\frac{1}{2} \times 348 \div 1{,}880 = \frac{493}{300} = 1\frac{2}{3}$ inches per second.

Finding the Distance

Knowing the rapidity of shutter and moving object, required to find the distance to place the camera to give an image with a circle of confusion less than 1-100th of an inch in diameter: Multiply 100 times the focus of the lens in inches by the space through which the object would pass during the exposure, and the result is the nearest distance in inches between object and camera. Example: A shutter works at 1-66th second, object moves four miles an hour; how near must camera be placed with an 8½-inch lens?

An object moving four miles per hour moves 72 inches per second.

∴ an object moving four miles per hour moves $1\frac{1}{11}$ inches in $\frac{1}{66}$ second.

$$8\frac{1}{2} \times 100 \times 1\frac{1}{11} = \frac{17 \times 100 \times 12}{2 \times 11} = 927 \text{ in.} = 75 \text{ feet.}$$

Watching for "Dead Points"

The secret of successful results with instantaneous work is to watch the moving object till it attains that position which the French call *le point mort*, and which is well seen in the case of a ball thrown perpendicularly up into the air. For some time the ball travels up, and then just for one almost inappreciable period of time it is stationary, and begins its downward course. The exposure should be made just at the moment of reversed motion. With almost all subjects some such "dead point" will occur, and this is the moment for the successful exposure.

Lest We Forget

These exposures, as already explained, are for objects traveling directly across the field of view at right angles to the lens. If the object approaches or recedes at an angle of 45 degrees, or at an angle of 10 degrees, then the exposures may be twice and thrice as long respectively as that required for the broadside view.

Similarly, the rule which says that the exposure for any given distance should be doubled in length for twice that distance, or halved for half that distance, should be kept in mind when using the Lawrence table, which practically covers most of the requirements of ordinary focal-plane work.

A Table

As a rough guide to the exposures required in photographing subjects including movement where the image of the principal object is to be 1 inch in height, the following table will be found useful. It is based on the use of a 5-inch lens at 50 feet, a 6-inch lens at 60 feet, or a 7-inch lens at 70 feet. The figures are suggestive and approximate only, and are variable by existing conditions at the time of photographing. The speed of the lens is supposed to be fixed at *f*/6.8.

Subject	At an angle of 45 degrees	Approaching at an angle of 10 degrees
Man walking (fast)	1-50	1-25
Skater (swift)	1-300	1-150
Sleighing	1-120	1-60
100-yards race	1-250	1-150
Half-mile race	1-200	1-120
Cycle-racing	1-250	1-150
Diving	1-300	1-150
Horses galloping	1-400	1-225
Horses trotting	1-250	1-150
Automobile (35 miles per hour)	1-250	1-125
Tennis, golf	1-300	1-150

Those who find these exposures beyond the capacity of the lens-shutter on the camera in use can, by working at greater distances, bring the exposures within the capacity of the shutter-speeds available. See page 185 as to this modification.

Hare's Table

As supplementing this table I reprint here Hare's table of approximate exposures needed for different classes of subjects. This table presupposes a lens working at *f*/6.8 and plates of standard rapidity. The differences between the figures given in this and the preceding table cannot be reconciled but may be explained by the fact that Hare is a focal-plane enthusiast and pins his faith to the higher speeds.

	Second
Man walking	1-150
Tennis player	1-200 to 1-400
Vaulter	1-400
Jumper	1-400
Horse walking	1-200
Horse running(direct)	1-500
Horse running (right angles)	1-1000
Man running (direct)	1-400
Man running (right angles)	1-1000
Football players and kindred sports	1-800

Baseball

Naturally we give first place among outdoor sports to the National Game. Here, as in all sport work, a practical knowledge of the points of the game, such as the city office boy possesses, will materially help in getting results. There are two sorts of baseball pictures: those taken at practice games, when the players will often pose deliberately, singly and grouped in action, and the others taken in an actual game, which naturally present more difficulty. Among the pictorial features of the game we have the procession up the field before play, the men at their positions, and so on. These have their characteristic poses and mannerisms, and require individual attention. In action, it will be noted that the pitcher holds himself at rest just before delivering the ball, twisting or gathering his fingers around the ball in his own peculiar way. Similarly, the catcher behind the batsman has his characteristic pose. Running to bases offers many opportunities for interesting records, expecially when a man "slides to base" at a close touch. Now and again very interesting groups are available as subjects when catcher, runner, and umpire all come within the field of view.

The velocity of movement in ball-delivery is such that exposures of 1-1000th second or less are required to show a clean-cut image of the ball in the air. It should preferably be photographed from a viewpoint where it is seen traveling toward or from the camera. A rare chance is given, now and again, when a catcher leaps vertically in the air to stop the ball. Players running for bases travel at about the same speed as in a hundred-yards' dash; at and around the bases the movement is less speedy, as a rule, the exposures ranging from 1-500th to 1-300th of a second in a good light. If the ball is the feature aimed at, the shutter must be speeded to its limit and the distance between it and the camera must be 50 per cent greater than when the player is the chief interest. A viewpoint should be chosen so that the ball travels directly to or from the lens.

If the results obtained at first seem far removed from the splendid illustrations given in public prints, let the reader remind himself that many, if not a majority of these are posed for on the field before or after the game, or at practice, rather than made during the game itself. Almost any player will take his characteristic pose on reasonable request, putting into it all the fire and zest of actual play in a big match.

Points from an Expert

Claudy, as expert with the camera as in the game itself, says: There is no reason why anyone cannot get good and attractive baseball pictures with an ordinary camera, if he is willing to pick and choose and does not simply blaze at everything he sees, and is satisfied with good pictures of the things he can take and to do without those he cannot make.

In the first place, then, let it be said that with the rapid rectilinear lens and the ordinary between-lens shutter, the small camera is to be preferred to the large one in making baseball pictures. Of course, a small camera and a small lens will give small images. These small images can often be enlarged, but if they cannot, then the small picture and willingness to accept it are your first point of compromise. The reason the small camera is to be preferred to the larger is found in the speed of the shutter. Admitting that the 1-100th of a second exposure of a between-lens shutter is actually that time, it will produce a sharper picture with a 4- or 5-inch lens than with a 7- or 8-inch lens, from the same standpoint, because the relative motion of the moving image of the ball-player on the plate or film is less as the focus of the lens is less.

In the second place, one must make up one's mind to this particular compromise—either to retire a considerable distance from the paths, or not attempt to take a runner at right angles or anything near a right angle. If one has or can get permission to approach the lines, then he must make up his mind that any picture of a runner at right angles is going to be blurred, simply because 1-100th second is too slow to enable him to stop such motion.

But in a small camera the 1-100th second is amply sufficient to stop motion taken head on, or nearly head on; at least, if that motion be a running baseball player. Nothing but a focal-plane shutter and extreme speed is going to catch the ball on the plate. There are photographs made, wonderful photographs, showing the ball almost caught, or even in the air between pitcher and batter. There are even pictures which show a batted ball, but they are rare, and more of them are made with the ordinary hand camera. At the end of every close play in baseball there is a moment, only a tiny fraction of time, when everything shows up and almost stops. If the shutter can be snapped in that tiny fraction of a second of time, pictures that appear to show very fast motion can often be secured with an ordinary camera. But it takes a nice bit of judgment to make the snap at that particular instant, and one has be to able to make the exposure without stopping to think.

The only plays that are easy to photograph are those at first, third and home. Second-base plays are too far off for anything but a lens of extremely long focus or of telephoto build; and, of course, plays in the outfield, except in amateur games in which the fielder has no objection to being followed around by a man with a camera, are impossible. Pictures of pitchers are usually disappointing, because showing nothing but a man in an attitude. No single-figure baseball picture holds much intrinsic interest.

If one will remember to get behind the motion or in front of it, to pick the moment when the swift motion has come to its instant's stop, to use his fastest shutter-speed and the largest opening of his lens, to focus accurately, to use a fast plate or film, and to be content with small figures, and not to try to imitate the professional press photographer, there is no reason why he should not combine the pleasures of the ballfield with those of the darkroom and secure many a pleasant souvenir to paste in his score-book as food for fanning bees when the winter winds begin to howl again and baseball is a thing of the summer gone by.

Lawn Tennis

I put this popular game here in the second place because, in practice, almost all that has been said of baseball applies to tennis, the action in the two games being similar in general character, although not so rapid in tennis as in baseball. Tennis is not an easy game to photograph, on account of the extraordinary velocity with which the ball is driven and the agility of the players; but the disposition of the game itself, while it is in progress, makes pleasing photographs. "The service," i. e., the manner in which an individual player strikes the ball, is the one important phase of the game the photographer should, and does aim for. One writer on the subject recommends that before exposing a plate it is best to wait during a couple of games to observe the characteristics of the server and decide how one is to photograph in order to exhibit most typically any special peculiarity that may have been observed, or previously heard of. One player may be noted for the remarkable height to which he throws the ball; for a picture of this description one would aim at snapping when the ball was at its maximum height and actually for a certain fraction of time at rest. A comparatively slow exposure can be given, since all movement—of player as well as of ball—is suspended.

The style of service varies with the individual player. One may throw a whole world of energy into the stroke, the racquet being flung well back and driven to meet the ball with enormous force; another player may exert the same force with apparently less effort. Good players nearly invariably serve from the same position on successive occasions, so that preliminary focusing is possible; they also vary their action at times. A player waiting to smash a ball which has been served to him makes a good subject for an exposure. As an exercise in training hand and eye, Adolphe Abrahams suggests the photography of a service which depicts the ball at the very instant it meets the racquet. He finds the exposures in taking the service 1-250th to 1-800th of a second, according to proximity. Good photographs with exposures so long as 1-50th can be secured; the ball will be sharp, but in all probability the racquet or some part of the player will be blurred. For other incidents in the game the focal-plane shutter must be driven at its fastest or the image will show movement.

Football In this popular game, whether "Soccer" or Rugby form be followed, the interest varies every minute. The underlying principle of both is the same: the ball has either to be manually shot, or kicked by the foot, between the goal-posts of the opposing side. Critical play, therefore, chiefly centers around the goals; but the play up the field is always the fastest. There the scrimmages, melées, and fast runs take place; there the passing, dribbling, and tactical shooting occur, and opportunities arise for making effective pictures of football groups.

The power of the light falls off from September to December and increases in value from January to April, but, except in very dark or foggy weather, this need not cause the photographer any vital trouble, as football does not call for the very highest speed-work, 1-800th being probably the fastest rate at which the shutter need work, most of the exposures being slower than this, really fast runs up the field being of infrequent occurrence. The photographer should take up a position—if he can get it—about 75 feet from the goal-posts, with the sun at his back, the lens being focused for an object about 60 feet off. It must be noted that play does not take place until well on in the afternoon when the light is diminishing in power, so that allowance must be made for this. Around the goal the most exciting play takes place, and there the greater number of players are gathered together at one time, so that the opportunities of exposing on characteristic groups are many.

The photographer must rely upon chance for these opportunities—the game changes so rapidly. It is a good plan to have the camera always focused and to release the shutter whenever a group of players comes into the range. Football is essentially a plate-using sport, so the photographer must make up his mind to be generous with his exposures. In the Rugby game, the "line out" should never be missed: a subject like this will require an exposure of about 1-600th of a second with the lens at *f*/6; passing, handling off, intercepting a pass, the "scrum," are lively group subjects which can be dealt with at about 1-500th of a second.

Abrahams wisely suggests getting to the match a quarter of an hour before the game starts, so that a front-row position at almost any part of the field can be taken. When the crowd is a very small one the photographer will be able to move about during the progress of the game, but, generally speaking, he will be obliged to maintain his first position. If possible, the position should be such that the sun is at the photographer's back, and a point about 75 feet from one of the goal-posts should be selected. In local matches the photographer will often be permitted to walk along the touch-line, otherwise he must remain behind the ropes, so that he will be from five to ten yards outside this line. The lens should be set at from 45 to 60 feet focus.

There is obviously a large element of luck associated with the proceeding. One may stay at a spot during the whole of a game without the ball ever coming near, but speaking from considerable experience I can say that one will be indeed unlucky if typical play does not take place at the spot I have indicated, even in the first fifteen minutes. There can be no hard-and-fast rule regarding what to take. *Let drive whenever the men come into your range of focus*, is not a bad plan to adopt, since sharpness of focus is, after all, a point of great consideration in such work.

Cricket

Cricket has lost much of its popular interest during the last decade and is rarely played in this country, while in England it tends to be a gentlemanly rather than a democratic sport. The photography of a game in progress from the spectator's part of the ground is a comparatively easy matter—admitting of exposures as low as the half of a second. No subject is easier, the thirteen white-clad figures being distributed over a smooth green sward, the ground being fringed with people and a bright sun shining overhead. The photography of individual strokes and bowlers' deliveries is, however, a matter of far greater difficulty. It is imperative that the photographer should himself know something of bowling and batting and that he should get close up to the work. The best way for the would-be photographer of cricket action to go about the business is to obtain access to the nets when practice is in progress. Part of the ground is usually netted off for the purpose and here, on off days and between whiles, the players practice themselves into condition. Let the photographer get permission to place himself within 12 or 15 feet of the bowler as he is delivering the ball. Focus the crease or stump and release the shutter when the bowler's arm is raised to make the delivery. An exposure of 1-400th second will probably show the bowler's particular "action" or method of delivering the ball. Similarly with the batsman. Take up a position some 8 or 10 feet to his "on." Focus the batsman as he stands waiting for the ball —never mind the bowler—and when you see the bat rising to meet the oncoming ball, release the shutter. An exposure of 1-500 second, in the most favorable circumstances, should give a good negative.

Foot-sports

Walking, running, jumping, hurdle-racing comprise a group of outdoor sports sometimes known as athletic sports; for our purpose they are best called foot-sports, so as to class them by themselves. The walk ranges in distance from one mile to five; in running, there are the hundred yards, the two hundred, the quarter-mile, the half-mile, the mile, the four-mile, the long jump, the high jump; in hurdle-racing, the one hundred and twenty yards is a popular distance. Cross-country running, from five to ten miles, is also much in vogue. The latter usually takes place in winter and gives many opportunities for camera work.

We will confine ourselves to foot-sports on the races ground; they mostly take place in summer under the auspices of clubs and colleges. The hundred yard running-race is the most popular event; the distance is covered approximately in ten seconds from the scratch, so that a high velocity is attained. Roughly, it calls for exposures of about 1-1000th of a second, at a distance of 30 feet, at right angles to the camera. As in most foot-races, there are two points of chief interest to the photographer, the start and the finish. The start is best photographed when the pistol fires. The men bend forward and wait for the signal. If the photographer stands at a distance of from 20 to 30 feet and has focused the spot, an exposure of 1-200th second will be quick enough, assuming a good light and other favorable conditions. Rapid movement does not come until after the first stride. If the photographer is taking the finish, he should choose a position in advance of the tape—some 20 or 30 feet away—and on the side of the track farthest from the tape-holder. Having focused the tape, snap when the leader has breasted it, giving an exposure of 1-450th second, though as little as 1-1000th second may be required, according to circumstances.

These rules apply to the starts and finishes of other rapidly run races. Walking-races come within the sphere of comparatively long-exposure hand-camera work down to, let us say, 1-50th second, or more. The hurdle-race is, of course, best photographed in one of its intermediate stages. Focus on one of the obstacles and, as the men rise, give an exposure of 1-200th second at a distance of 25 feet. Long races should be photographed at an early stage when the men are well together and before they have begun to fall off. It is, of course, possible for the photographer to get nearer, on special occasions, than the distances mentioned. Especially in the intermediate stages of races, large-sized figures well repay the trouble.

The best and most satisfactory work in foot-sports photography is done either at the start or the finish of a race, for then the photograph tells its best story. The long and high jumps are obviously best taken from a fixed point. In the former, a point midway between the estimated distance should be focused and on an exposure of 1-500th second at a distance of 20 feet given; in the high jump about the same exposure should be given just as the man clears the bar. Familiarity with the points of the sport of the moment will best guide one in these things.

100-Yard Races

Todd points out that when we say that a man ran 100 yards in a little less than 10 seconds, the statement is true of his trunk only, as the feet, while in motion, travel just twice as rapidly. So, in calculating the shutter-speed, it must be decided whether or not the entire image of the runner is to be perfectly sharp. With a lens of 6-inch focus, the runners must be photographed at a distance of about 25 feet, and if they are moving at right angles to the lens, the shutter-speed of 1-700th second will give a perfectly sharp image of the body in a 100-yard race, but the feet will not be clearly defined. To get perfect definition of the entire image, it is necessary to give an exposure of not less than 1-1400th second. Pictorial reasons, in addition to mechanical ones, advise that the figures should be moving at an angle of 45 degrees, or thereabouts, to the lens, and with this condition the exposures will be 1-500th and 1-1000 second respectively. For long races a slightly slower shutter-speed is permissible, but the largest stop of the lens must always be used.

In a 100-yard race it is advisable to select a position close to the start or the finish, while in longer races, a position about 100 yards from the start will give interesting pictures, as the runners generally separate at this distance.

Golf

This royal game has been so much abused by photographers that I am fain to call attention to its photographic possibilities from a new angle. We are surfeited with golf pictures featuring expert players at critical points of the game. In such work, because of the great velocity of the movement, not only of the ball, but also of the player and his limbs and club, photographs worth while as records of fine play can only be secured by one equally skilled in the technique of the game and in the use of a focal-plane shutter. Almost all the outstanding shots are beyond the capacity of the between-lens shutter and so out of reach of most hand-camera workers. But by avoiding these sensational plays the reader with a hand camera of the better sort and an eye for the pictorial side of the game will find many opportunities for getting pictures of unusual interest on the links. These will, for the most part, be groupings of players and spectators at different points in the game, or landscapes with figures but without lively movement. An example is seen in the illustration which shows Travers making a putt, where the exposure probably did not exceed 1-100th second. Even a drive from the tee, ordinarily one of the most difficult shots to photograph, may be recorded with a hand camera if the worker can catch the moment of apparent rest at the end of the drive, when the player is motionless, or almost so, for the fraction of a second. For a single figure with action, the bunker shot is a favorite subject. The moment for exposure is when the tiny ball is lifted out of its sandy pit and sent over the top in a cloud of sandy earth and pebbles. With favorable light conditions this shot can be recorded with a shutter speed of 1-300th second.

For the technically characteristic points of golf only a focal-plane shutter at its high speeds will suffice. These points are the drive, the brassie or approach shot, the iron or bunker shot, and the putting shot on the green. At 50 feet an exposure of 1-1000th of a second will generally register the action of a fast drive; brassie shots require about the same speed; the bunker shot will need from 1-300th to 1-450th of a second, according to the player. In photographing during a match it is important that the photographer should not inconvenience the player by noise or movement in his camera work as trifles are apt to put a player with tense nerves "off his stroke" at the critical moment of the play. For this reason it is difficult to get permission to photograph such special subjects.

Water Sports

The summer holiday by the sea or by lake or tidal river will offer many opportunities for making pictures of water sports, such as swimming, diving, boating, canoeing, sailing and yachting. The open sky and great reflective power of bodies of water make it a comparatively simple matter to get fully exposed pictures of subjects including rapid movement, with fairly short exposures.

Swimming Photographs of swimmers are best obtained by following the swimmers in a boat. The most favorable conditions are sunlight and very transparent water. Effective light and shade arrangements, with the head and shoulders of the swimmer, may be had by "watchful waiting" and exposures of 1-50th second to 1-100th second at a distance of 15 to 20 feet away.

Diving Pictures of divers are only obtainable from a pier head or the diving-float usually anchored a few hundred feet out from a bathing-beach. The best position is one which gives the photographer the full range of the dive within his field of view from the board to the point of entry into the water. This field should be carefully focused beforehand; as the movement is in a straight line after the rebound or spring from the board, this will permit characteristic pictures to be made of any point of the action.

The exposures in diving will generally range among the higher speeds of the focal-plane shutter because of the extra movements of the limbs and head apart from the forward velocity of the body. Thus, exposures of 1-400th to 1-1000th of a second are common where expert divers are at play. But the subjects are usually silhouetted against the sky or water, so that slight underexposure helps rather than detracts from the pictorial value of the picture, and the lens-shutter working at 1-200th to 1-300th second will get effective records if skilfully handled.

Water Polo This is an exciting water sport for the photographer, being practically football played in the water, but it is not very popular and so its opportunities are not often available. The action is slower than in football, and the method is to focus upon a carefully selected spot in the field of play and make exposures whenever the players come within range. The reflecting-mirror camera is most advantageous for this special work, and the exposures will range from 1-100th second from a distance of 60 feet to 1-400th second when working at fairly close range. From this it is obvious that a hand camera with a high-grade lens-shutter can do good work in water polo when the chance offers.

Rowing

Those who are fortunate in living in the vicinity of a big university or boys' school will find many interesting opportunities for sport photography in the aquatic activities of the students. Rowing and boat-racing, sculling and canoeing, all offer a delightful field for the camera. The work being generally done from the bank of the river, the necessary distance between camera and subject, the abundance of light reflected from the water and the light clothing worn by the men all simplify the problem of exposure and bring successful pictures well within the capacity of the hand camera with its lens-shutter. Favorite subjects are college eights and fours, but pairs and singles and crew try-outs furnish interesting experiences.

The regular movements of rowing and the fact that boats racing rarely travel 20 miles an hour (352 inches per second), and in practice-pulls much less, call for exposures from 1-50th to 1-150th second. But, of course, if one is working from a boat and nearer to the subject, these exposures must be very much shortened, and a focal-plane shutter will be needed in dull weather.

In photographing eights and fours it is best to make the exposure at the beginning or at the end of the stroke. If you doubt your ability to get the boat in focus and yet within the limits of the plate with the oarsmen in the most desirable position, sacrifice something of the length of the boat but see that you always get the bow.

Striking pictures of a race may sometimes be had from a bridge, the camera pointed down at the water. Here the distance makes a long-focus lens desirable. Abrahams speaks of using a 14-inch lens at *f*/16 on such an occasion, the exposure being *f*/16. Very interesting pictures are obtainable from the boat-landing, at the setting out and return of the crews.

Yachts: Sailing-Boats

This is a wide field of work, varying with the tastes of the individual, who may, if he is of the disposition, include motor-boating as within its scope.

Serious yacht photography, according to Mortimer, can be accomplished only when the photographer is himself on the water in another boat. It is necessary that the standpoint should be capable of being quickly altered. There are three good standpoints: (1) The photographs may be taken from another sailing yacht well under control; (2) a small boat may be used and manœuvered so as to get into the track of a race; (3) a power-boat, such as a steam launch or motor-boat, may be employed. By this method a race can be followed, the boats photographed at any point or distance, and it is possible to circle round a fleet of racing yachts and secure a variety of pictures. It is advisable not to get too close to racing yachts, as it is not so much the danger of being run down that is to be feared as the sweep of the boom which may clear the decks of a smaller craft. The focal-plane shutter, unless the camera is a small one, and the shutter used at a high speed, is not a success for yacht photography.

The appreciable time that a large focal-plane shutter takes to pass across the entire plate is apt to be productive of a slight blurring distortion, which becomes very marked in viewing the fine, straight masts and spars that are vertical, or nearly so. The light is nearly always good enough on the water to drive a between-lens shutter at its highest speed with a fairly small stop—about *f*/16.

The camera advised is the rigid-box form, because it is not only easier to hold, but better protected for hard wear than other cameras. In fine weather a reflex enables a moving object to be focused up to the instant of exposure. The camera should be covered up with a waterproof focusing cloth and protected as much as possible from the salt spray. A direct vision-finder is advised, made of wire the same size as the plate; this should be divided by cross-wires into quarters, and fixed to the camera front over the lens so that its base is level with the top of the camera. By holding the camera at the eye-level and aiming it like a gun, so that the picture is inclosed in the wire frame, the actual view itself is seen. Very fast films or plates are not necessary, owing to the high actinic value of the light; high-speed orthochromatic plates and light filters can be used, so that gradations of light and color between white sunlit sails and blue sky and clouds can be secured.

Mortimer gives exposures of 1-100th of a second for such work. A great deal of this advice, in our experience, can be switched from the photography of racing yachts to the photography of smaller sailing-boats, such as those on rivers and lakes; the work does not come within the scope of specially made cameras, but rather in that of ordinary hand-camera photography with exposures ranging between 1-10th and 1-100th of a second. Indeed, the simplest form of Kodak answers for the purpose; the subjects make pleasing photographs, and the work is so easy that it needs no special description here—small sailing-boats do not move very quickly, are easily focused, and permit of comparatively long exposures, the finder image giving a good guide to their position on the focal-plane. For this work a focal-plane camera is not imperative.

Field Events

At many colleges and boys' schools exhibitions of the minor sports are collectively grouped on field days. These exhibitions comprise hurdle races, the high jump, the long jump. It is important in any photographing of these events, either to obtain beforehand the permission of all the athletes taking part, or to work from such a distance that you will not distract or interfere with their performance in the least. In a hurdle race the best position is at the first hurdle as then the runners are sure to be together. In a high jump, straight jumpers may be taken straight in front of the bar, but look out for men who jump sideways and turn around in mid-air, who are best photographed from behind as it is always desirable to get a full face view of the jumper. Do not change your position as the men jump as this is liable to disconcert them and cause serious failure on their part. In the long jump, position is of little consequence so long as it is not so near as to be within the jumper's objective view; from 18 to 36 feet is a good working distance.

Under favorable conditions exposures in hurdle racing will range from 1-200 to 1-1000th second, because of the extra movement of parts of the body.

High jumps require top speed focal-plane exposure for the same reason. Long jumps can be successfully recorded with from 1-50th to 1-150th second exposure.

Winter Sports

In the photographing of winter sports, such as skating, skiing, tobogganing, curling, the lack of light during the winter months is largely compensated by the actinic value of the snow and the fact that the figures in the scene will look to greater advantage if silhouetted against the light surroundings rather than fully detailed by ample exposure. Two suggestions may be helpful: To express the idea of movement in progress and not momentarily arrested, it is necessary to try and get a position where the figure appears as if it must move by reason of the apparent steepness of the slope it is on in tobogganing and skiing. Movement can also be suggested by the presence of flying snow from a ski-stick, or a tobogganing rake, or by taking a rider while still in the air during his leap.

The other suggestion is to take a slightly elevated position when photographing many persons who are all on a dead level, as skaters on a pond or a curling match, as this will separate the figures to advantage and give more pleasing effects.

In making pictures of individual skaters remember that when once a fast skater gets started, he or she travels about 50 per cent faster than a swift runner. The most favorable condition for successful pictures is to expose while the skater is curving round in the direction of the camera. For the work of the specialist a focal-plane shutter offers definite advantage because of its great light efficiency, but on bright days the lens-shutter will generally meet all requirements with its speeds of from 1-100th to 1-300th second.

In skating, there is "a moment of rest," so that the exposure need not be so brief as in skiing. The camera may be held, in this work, within 12 or 15 feet of the moving figure. Snow reflects a great volume of light, a fact to be remembered in determining the exposure.

In ice hockey we are dealing with objects moving at a fairly low rate of speed, and the photograph can be taken from a distance of say 50 to 100 feet.

The game of curling, more popular in Canada than in this country, does not call for extremely quick exposures since there is no very rapid movement in the game. The essential things here are an interesting grouping of the figures in the game and the spectators, with as clear a view as is possible of the "tee" and the stone speeding on its way over the ice.

With which our brief survey of sport photography must draw to its end. Grateful acknowledgement is made of the help I have obtained from the papers of the workers mentioned in these pages, and especially of the writings of Dr. Adolphe Abrahams whose little volume on this special field, published some years ago, is still the only work available on the subject outside this Series.

Notes and Comment

Frederick Gutekunst, the beloved doyen of American photographers, died at Philadelphia, April 27, in his eighty-fifth year. Mr. Gutekunst had spent an active life of more than sixty years in professional photography and had, up to the time of his death, probably photographed more celebrities than any other man living. He was a photographer of the old school, enthusiastic in his profession and insistent upon good straightforward portraiture. His portraits of the Civil War generals and notabilities have given us imperishable human documents of the giants in that great struggle, and his fame rests securely upon his work. American photography is the poorer for his passing.

Photographers who are interested in marketing their photographs for publication can always find the latest news about this growing market in the pages of *The Editor*, a fortnightly published, at $2 a year, by the Editor Company, Ridgewood, N. J. *The Editor*, as its name suggests, is a paper for literary and journalistic folk, but it also covers the field of illustration in a praiseworthy way. I note that the journal is to be published weekly and the subscription price advanced to $3 per year beginning July 1 next. "Now is the time to subscribe."

I am glad to note a widely increasing appreciation of special color sensitive plates and the Wratten K Filters made under the supervision of Dr. C. E. Kenneth Mees of the Eastman Kodak Company. The very positive advantages secured by the proper use of orthochromatic or panchromatic plates and adjusted color-filters have been preached in season and out of season in these pages, but we had to wait for Dr. Mees to put this advance in photographic practice upon a practical and commercial basis, available to all who have need of it in the reproduction of colored objects. The reader who is not fully informed about orthochromatism cannot do better than get a copy of "The Reproduction of Colored Objects" by Dr. Mees and apply its common-sense in his work. The book costs 60 cents, postfree, and is worth its weight in gold.

The Clarence H. White School of Photography, founded and still directed by the triumvirate Clarence H. White, Paul L. Anderson, and Max Weber, will hold its eighth summer session at Canaan, Conn., during July and August, 1917. Canaan is situated in a beautiful valley in the Berkshire Hills, about four hours' ride from New York City, at an elevation of about eight hundred feet above the level of the sea, and surrounded by hills on every side. Those who seek to combine the best sort of a summer holiday with instruction in pictorial photography should get in touch with Mr. White before July 1 at 230 East 11th Street, New York City.

Alvin Langdon Coburn, good friend and master pictorialist, has recently "set the Thames on fire" with an exhibition of "Vortographs," which are the photographic products of "vorticism," which (I quote from a London exchange) "is a kind of disembodied phase of modern art stripped of everything but tone and line and the esthetic appeal which these make. It is," as the exchange goes on to say, "the dry bones of art," but apparently Mr. Coburn has answered the scriptural query and has "made these dry bones live." Vorticism does not seem to have won much favor among English pictorialists as yet. Mr. Craig Annan sums up his opinion in the saying "There's nothing in it;" another critic speaks of it as "a mere tickling of the sensory nerve." I am dying to see a Vortograph and, if my friend Coburn will only send me one, I will reproduce it in these pages if it is reproduceable and not absolutely shameless.

The Graflex 1917 Catalogue is more elaborately interesting than it has been for many a year, both in its information and in its illustration. I note the reintroduction of the Stereo Auto Graflex and the Stereoscopic Graphic, both, of course, fitted with the Auto-Graflex shutter. Another novelty is the F. & S. Finger Print Camera, recently described in these pages, and the Telescopic Revolving Back Graflex. Those who want to excel with sports and the camera should get a copy of this new catalogue from the nearest dealer.

"Cinematography for Amateurs," A Handbook for Beginners in Motion Photography. By Leonard Donaldson, 94 pages, illustrated with numerous halftones and diagrams. Cloth, 60 cents. London: Hazell, Watson & Viney, Ltd. New York: Tennant and Ward.

In this little handbook, Mr. Donaldson aims to give the beginner in motion photography practical and comprehensive instructions which will enable him to take up the work of making motion pictures either for his pleasure or profit. The book is so thoroughly helpful and so simply written that I wish there had been more of it. It deals with the choice of the camera, focusing, the proper use of the shutter, the arrangement of the story and its portrayal before the camera, taking the film, with hints on studio construction, developing, printing and projecting the film. There are also chapters on the money-making possibilities of the motion picture, faked films, trick effects and miscellaneous hints and suggestions.

The C. P. Goerz American Optical Co., of New York, advises us to urge upon our readers great care in buying second-hand photographic lenses, stating that many lenses are being sold today as the product of reliable makers while, as a matter of fact, the lenses have been replaced by cheap rectilinears or absolutely worthless pieces of glass, the original cells of the manufacturer's lens being made use of to deceive the buyer. It is suggested that where second-hand lenses are not purchased from reputable dealers, they should be secured on approval and submitted to the manufacturer for tests, which will usually be made free of charge.

A specific case of this kind has recently been brought to the attention of the C. P. Goerz American Optical Co., where a lens engraved "Goerz, Series III, No. 7, 14 inches focus, No. 43711," was found to fail in giving satisfaction. When examined by the manufacturers it was discovered that the original glasses had been replaced by inferior and worthless lenses, so that the buyer had really paid a very high price for a spurious imitation of the well-known Goerz lens.

I have received from Burke & James, Inc., Chicago, an interesting catalogue of the Universal Camera, a high-grade instrument meeting the most exacting requirements of motion photography. The catalogue is fully illustrated and shows the mechanism and operation of the camera in detail. Those who are interested in this rapidly growing field of moving-picture work should send to Messrs. Burke & James for a copy of this new catalogue.

The new Kodak Catalogue for 1917 is now ready for distribution at your dealer's. It includes an illustrated description of the complete Kodak line for the new 1917 season and specially features the new Kodak Range Finder which gives the correct focus to a hair and increases the efficiency of the Kodak a hundredfold. The autographic feature, now applied to so many Kodaks and Folding Brownies, is also brought prominently before the reader. Among the novelties I note with interest the reintroduction of the Stereo Kodak, which is now supplied with carefully matched Kodak anastigmats *f*/7.7 and an automatic shutter, with many other improvements not found on the earlier models.

A very interesting development of the motion picture is embodied in the motion-picture portrait system recently perfected by G. Bettini, of New York. This system consists of nothing more than the taking of motion pictures of the subject in the studio, the exposures being made on the ordinary dry plate at the rate of twelve per second, while the subject is assuming a number of natural poses appropriate to what is passing in his or her mind at the moment.

The plate is large enough to take something like five hundred exposures, each picture image being about ⅜ inch square, this offering sufficient opportunity to record many natural poses of a subject, such as a woman sitting down before a glass, removing her hat and gloves, fussing with her hair and so on.

As soon as the camera has recorded the full series of poses, the negative is removed from the camera and developed. A positive or lantern-slide is then made from the negative and this is projected upon a nearby screen, which allows the patron to choose the most pleasing poses in the series. These being marked, the negative is later placed in an enlarger and the selected pictures of the subject are enlarged to about 7 by 9 inches.

Special means are employed to prevent any graininess in the finished picture resulting from this excessive enlargement, the finished result being a portrait with the animation and natural expression of the subject, free from all suggestion of deliberate pose and enhanced by the suggestion of life and action. Those who wish to inquire further into this interesting invention should write to the Bettini Syndicate, Ltd., 17 West 44th Street, New York, asking for their illustrated booklet.

Many notable improvements are embodied in the new No. 2 Harvey Exposure Meter introduced by G. L. Harvey, 105 South Dearborn Street, Chicago. These add largely to its general efficiency and widen its usefulness. Send for the booklet.

DUPLICATING AUTOCHROMES

One of the disadvantages of the autochrome method of direct color photography is that, like the daguerreotype method, the result obtained is a positive. In the early days of the method no process was known by which the autochrome color record could be reproduced or duplicated, except by making other autochromes of the same subject direct in the camera.

Very quickly, however, this disadvantage was remedied by the introduction of a method of duplicating autochromes by reproducing as many duplicates as were desired from the original record. The crude methods at first employed resulted in many failures and duplicates of poor quality, but eventually the duplicating methods were perfected and now it is a comparatively simple matter to make duplicate autochromes from the original color record.

Henrietta Hudson, whose work in color photography was noticed in The Photo-Miniature No. 158, has been especially successful in the use of this method. By her permission I take from a letter addressed by her to the editor of the *Bulletin of Photography*, May 2, the following instructions for making an autochrome negative and producing as many positives from that negative as may be desired at any time. I quote: "Expose an autochrome plate, develop it in the developer you are in the habit of using for autochrome plates, giving a somewhat fuller development than usual; rinse in clear water and fix in an acid hypo bath (it will take about two minutes to fix the plate); then rinse about a minute and you will then have the *direct color negative* all in the complementary colors; a red rose will be green, the leaves red, a blue background yellow. Dry the plate, bind with cover glass to protect it.

"To get the positive, copy the negative in a camera exactly as you would a lantern-slide, taking an autochrome for the positive, develop and fix exactly as you did the negative, and the result will be a positive in the natural colors of the object photographed; the rose will be red, the leaves will be green and the background blue.

"Details to be considered:

"If you take your negative by daylight, make your copy by daylight with the proper screens.

"If by artificial light, copy by the same light with the correct screens for that light.

"Use normal strength developer and full development for the negative.

"Use half strength developer and short development for the positive, as an over-development of the positive results in a black-and-white positive.

"Establish the correct exposure for copying, and the duplicating of autochromes becomes a simple matter indeed. By this method direct color photography is made commercially possible in many ways as the duplicating can be done reasonably and quickly, and is invaluable where correct color expression is needed."

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Hand Camera Tips and Pointers

We were talking about the man with a hand camera and his chances of success. I had pointed out to my friend how many helps the hand camerist had in the photographic journals, and how THE PHOTO-MINIATURE especially had covered the field of hand camera work with half a dozen handbooks full of direct and practical information. "True," replied my friend, "but THE PHOTO-MINIATURE demands intelligent thinking of its readers, and the average amateur does not care for thinking things out. Why don't you get out a little book full of brief tips and pointers on hand camera work, which a chap could grasp at a glance, so to speak." I recalled Mellen's "New Pointers for Amateurs" of years ago and its remarkable popularity and determined to follow the suggestion. The result is this little book, in which I verily believe that you will find more hand camera tips and pointers than in any other single volume as yet published. I have tried to let the points and tips follow each other in loose but coherent order, from the technical details of apparatus, conveniences and manipulation to the treatment of the various sorts of subjects which interest the average man or woman possessing a hand camera. If you will keep this arrangement in mind, it will help you to quickly locate any subject about which you may want information—if it is in the book at all.

Making a Good Start

Don't start out on your summer vacation, or any extended trip away from home, with a new, untried hand camera. Even the simplest fixed-focus box demands a preliminary acquaintance if it is to produce a reasonable percentage of good pictures. But the average hand camera should be thoroughly well known, and all its movements and operations mastered before the day of departure. Learn how to open and close your camera without buckling the film or scattering dust all over its surface. Familiarize yourself with the finder and test its accuracy for "finding;" drill yourself in the use of the focusing scale, and last, but not least, be sure that you have thoroughly mastered the working and peculiarities of the exposure shutter.

Seek Out the Vital Factors

Whatever line of work is chosen as a specialty, the first thing to do is to get acquainted with the factors on which successful work in that field will depend. This will save lots of waste in time and materials. For example: in street photography we need, above all else, accuracy in the use of the view-finder and focusing-scale, facility in judging distances in feet, and a sure knowledge of the amount of depth of definition given by the different stops of the lens employed. In this field, too, we shall want to know something about the varying rate of movement likely to be encountered and how to use this factor in calculating the longest possible exposure, the right shutter-speed to use, and so on. The question of illumination is a detail which calls for special attention in street-work, often determining whether the plate will be under- or over-exposed, and having a marked influence on the effectiveness or pictorial value of the view. In the photography of moving objects, the size of the picture image is the first consideration; on this depends the working distance, the speed of the shutter, and so on. Every special field has its controlling factors, and these must be known before attempting actual work.

The Vest-Pocket Outfit

Almost everyone today carries a vest-pocket or miniature camera, but few seem to realize that the practical efficiency of such a camera can be trebled by simply adding a K1 or K1½ color-filter and a portrait attachment to the outfit for occasional use, as when the color contracts in the subject are emphatic in character, or for obtaining large images of small objects at close range and for portraiture.

Dust: Pinholes: Scratches:

Here is a very old dodge, as useful today as when it was first published in, say, the eighteen-fifties. The most frequent cause of pinholes in negatives and of long scratches or minute transparent streaks on roll-films, and especially on films exposed in a pack, is simply dust inside the camera. Before going on holiday, and especially during a vacation at the seashore, it is wise to take a camel's-hair duster or an almost dry, damp rag and carefully go over the inside of the camera, holding it with the lens pointing upward. First, fully extend the bellows, and then, holding the camera as described, gently blow the dust out from the inner corners, finishing by the use of the duster or rag as suggested. Don't use oil or glycerine.

Three Extremes to Avoid

Although a big percentage of our exhibition pictures display the skilful handling of extremes in distances, definition (or the lack of it), and light and shade, these are three extremes which the hand camera worker will wisely avoid. Scenes with extremes of light and shade offer difficulties beyond the capacity of hand camera exposures; views in which dark near objects and distant landscapes are included offer difficulties which spell failure, both in exposure and development; while a picture dead sharp all over is as disappointing as one in which every object is blurred and flattened by excessive diffusion.

The Four S's

Before you make an exposure, check over the four S's which must be considered if you are working for results. They are as follows:

(1) Subject—viewpoint, lighting, position within picture space and general effect. (2) Scale—estimate the distance of the object of principal interest, or the object on which the principal focus is to rest, then set your focusing-scale for this distance. (3) Stop—con-

sider the range of depth of field within which you desire objects sharply defined and set your stop to give the desired depth of focus. (4) Shutter—determine the correct exposure for the subject, based on the lighting, color of subject, general character and the stop in use, and set the shutter for the speed giving the exposure required for the scene or subject.

Keep Your Lens Clean

Dirty lenses make flat pictures. A dirty lens is one the surfaces of which are covered with fine dust or veiled with a greasy film caused by the action of atmospheric changes, or smudged and dulled by greasy finger-markings. If you want clear, brilliant negatives keep your lens-surfaces clean. Dry dust may be removed with a soft camel's-hair brush, carefully handled. Then breathe gently on the lens-surface and wipe it gently with a clean well-worn piece of soft cambric. Do not use tissue paper or wash leather or alcohol or any sort of polishing material. If you have to remove the combinations of the lens from its mount or shutter, remove one at a time, clean it and replace it in order to avoid transposing or misplacing the components.

Working Under Fixed Conditions

A good rule when setting out for a day with the hand camera is to adjust the shutter speed to 1-25th second and set the lens at its largest aperture before starting out. This means the widest exposure efficiency. Look at your depth-of-focus table and keep in mind the distance which will give you the maximum depth of focus with your lens and the stop employed and then go through the day's work without bothering to change the factors for slight variations in subject or light. This plan will generally give you a larger percentage of good negatives than the other way of "fussing" over details before each exposure.

Selective Focusing

When using a hand camera with a focusing-scale do not imagine that by setting the pointer at the infinity mark you are going to get everything in focus. As a matter of fact you will find that the foreground is rarely in focus at all; if you have your lens so close to the plate, and if you are working at a large aperture, say anything larger than $f/11$, you will find that the foreground is positively woolly. The best distance to set the pointer for ordinary figure work is about 15 or 20 feet, and you will then get good detail in all the more important parts of your picture and gain a slight diffusion in the background, which will suppress unnecessary detail behind your figures and make them stand out better. Of course, for objects that are really a long way off, like yachts from the end of the pier, or trees against the skyline, or even figures a long way from the camera, the pointer can be set further back, but in the majority of cases it is better to sacrifice the distance, to throw the nearer objects into greater prominence.

Converting a Focusing to a Fixed-focus Camera

One of the reasons why the beginner with his cheap, fixed-focus camera often gets a bigger percentage of satisfactory pictures than another worker with a more expensive, focusing hand camera, is that the fixed-focus camera is permanently adjusted for generally favorable conditions, and nothing is left to the calculation or guesswork of the user. You can change your Kodak into a fixed-focus camera instantly by adjusting the focus, the shutter, and the lens-aperture as shown in the table below, for which I am indebted to a recent number of *Kodakery*. In the use of a Kodak so adjusted be careful to work from the distance away from the camera at which the focusing-scale is set according to the table, viz., 25 feet.

With a No. 1, or No. 1A, or No. 2C Autographic Kodak Jr.; or No. 2A, or No. 2C Folding Autographic Brownie; *when fitted with achromatic lenses*, set the focus at 25 feet, the shutter-speed at 1-25th second and the stop midway between 1 and 2.

With all the cameras listed above, and No. 1A, or No. 3 Autographic Kodak, *when fitted with RR lenses*, set the focus at 25 feet, the shutter-speed at 1-25th second, and the stop midway between 8 and 16.

With all the cameras mentioned in the two preceding paragraphs (except No. 2A and No. 2C Folding Autographic Brownie) and with the No. 1, or No. 1A, or No. 3 Autographic Kodak Special, *when fitted with $f/7.7$ lenses*, set the focus at 25 feet, the shutter-speed at 1-25th second, and the stop midway between 11 and 16. Everything beyond 15 feet will be in focus.

Depth of Focus Rules

(1) Depth varies inversely as the square of the focal length. Take two lenses of 4 and 6 inches focal length respectively—4 squared is 16, and 6 squared is 36; 36 divided by 16 is 2¼; therefore the 4-inch lens gives a field of depth of focus 2¼ times the depth of the field with a 6-inch lens, using the same stop or aperture in both cases. (2) Each alternate stop or aperture smaller doubles the depth of focus obtained. That is, with any lens *f*/11 will give twice the depth obtained with *f*/6, *f*/32 twice the depth obtained with *f*/16, and so on. These rules account for the great depth of focus obtained with the very short-focus lenses used with miniature or pocket cameras.

Finding "Stop" for Given Distance

To figure out quickly a larger stop or lens-aperture that will enable us to include objects as near as "so many" feet, for example: What is the largest stop we can use to include objects 12 feet and beyond with a lens of 5 inches focal length? Square the focal length, i. e., 5 × 5 = 25; multiply this by 4 = 100; divide 100 by 12 = 8—practically *f*/8. Here it would perhaps be safer to cut the aperture down to about *f*/9. To put the question another way: How near may we approach an object with a 6-inch lens and an aperture *f*/8? Square the focal length as before, i. e., 6 × 6 = 36; multiply 36 by 4 = 144; divide this by the *f*/ number, viz., 8 = 18, that is, 18 feet.

"Stop" Values and Focal Length

When using a tri-focal or convertible lens, i. e., a lens which offers three lenses of different focal lengths in one, it should be remembered that the *f*/ values of the stops or apertures change when the front or rear half of the lens is used alone. Usually each component is double the focal length of the complete lens, in which case the diaphragm number simply requires to be doubled for the single element, that is, four times the exposure should be given as compared with that required by the complete lens. Other lenses are made with one component double and the other one and one-half times the focal length of the combination. In the case of the latter, the exposure will be one and one-half by one and one-half times that required with each stop when using the complete lens. For example, we have a convertible of 5 inches focal length, made up of lenses of 10 and 7½ inches focus respectively. The *f*/ values of the stops will be as follows:

Complete lens .	*f*/5.6	*f*/8	*f*/11	*f*/16	*f*/22
10-inch focus .	*f*/11	*f*/16	*f*/22	*f*/32	*f*/45
7½-inch focus .	*f*/8	*f*/11	*f*/16	*f*/22	*f*/32

U. S. Values of *f*/ Apertures

The rule for calculating the U. S. value of any lens-aperture already marked with a figure representing its / value is to square the *f*/ number and then divide the product by 16. For example, if the *f*/ value is 6.9, then the U. S. value of that aperture is 6.9 × 6.9 divided by 16=2.9. Similarly, the U. S. value of *f*/7.7 is 7.7 × 7.7, divided by 16=3.7.

Follow this Saving Rule

A wise rule for the beginner is "Always set your shutter at I" (instantaneous) before closing the camera or after making a "time" or "bulb" exposure. This will save many a picture which will otherwise be lost because it needs an instantaneous or snap exposure, whereas, if the shutter remains at T or B, there will be movement in the subject or grievous over-exposure in any event.

A Lens Shade

You can directly improve your outdoor snapshots by the use of a simple lens-shade. This means clear, brilliant negatives with sparkling lights and transparent shadows. It also means that you can photograph against the sun, which will often add pictorial effect to an outdoor subject. A collapsible circular hood may be made from one of the collapsible aluminum drinking-cups readily obtainable or a black paper cone will serve the same purpose. Many designs of simple lens-hoods are given in The Photo-Miniature No. 158.

The Ideal View-Finder

To my mind the ideal view-finder for everyday hand-camera work is the simple wire-frame lensless finder, of the same size as the film in use, permanently or temporarily adjusted over the lens- or shutter-mount. This means using the camera at eye-level, but the height of the camera from the ground can be varied when this is necessary by taking a kneeling or sitting position. The wire-frame direct-vision view-finder described gives the whole of the subject as it will appear on the plate or film (except for very near objects). The subject is right side up; precise adjustment of position so as to include or omit this or that feature of the scene is easily made, and any movement in the subject can be followed right up to the moment of exposure. There can be no view-finder mistakes where this form of finder is intelligently used.

Checking the Finder

For the average subject at a reasonable distance from the camera, the disparity or difference between the picture-image on the mirror or brilliant finder and the lens-image as given on the plate is negligible. But when the subject is within a few feet of the camera there will be a difference between the two images, viz., the picture-image may be more to one side of the plate or film than was indicated in the finder or possibly too high, according as to whether the finder is at one side or fixed above the lens. The difference in focal length of the finder lens and the camera lens will also cause a difference in the images where near objects are concerned. The remedy is to make sure that the picture-image is well within the confines of the finder in such a case, so that the disparity in position may not interfere.

Judging Distances

It is unfortunate that so large a measure of success with the hand camera depends upon the worker's ability to judge distances correctly—one of the big difficulties in hand camera work. The following method can therefore be recommended for training the eye, and when once the lesson has been thoroughly learned, it is difficult to go wrong. The procedure is as follows and involves little time or trouble:

When out walking, choose a number of feet, say 25, and as each street-corner, pillar-box, lamp-post, etc., is approached, a guess is made as to when you have arrived at a distance of 25 feet from the object. It is then measured with full strides—each stride being approximately three feet.

This is repeated with the next convenient object, and on all possible occasions for one or two days, until the eye has got a good grip of the 25 feet distance with all sorts of objects and under different conditions.

Follow this with another distance, say 15 feet, and continue the exercise until this is well drilled into the eye. Several distances, e. g., 15, 25, 50, 75, 100 feet can be thoroughly learned in this manner with practically no trouble, but only a little thought every time you go for a walk in town or country.

The next course is to stop at all sorts of irregular distances during our walk, e. g., 18, 30, 40, 60 feet, guess the distances at once, and then verify by long strides.

Then the new power thus obtained can be applied to the hand camera, and, provided the scale is correctly marked, very few spoilt plates or films will result through being out of focus.

The best, i. e., most useful of all distances to get well fixed in one's eye, is 25 feet, as this is in many cases the nearest distance one can have foreground figures (on a quarter-plate with 5-inch lens) without the near figures looking out of proportion in comparison with others at, say 50 feet distance.

Size of Image

Difficulty is often experienced, when working without a focusing-screen, in calculating the relationship between the size of the object photographed and the size of the resulting image, or in other words, the distance to place the camera away from an object to obtain an image of a given size. The average view-finder is notoriously deceptive on this point. The following method may be found useful in such a case. If the distance from the object is divided by the focal length of the lens, and the height of the object is divided by the result, the answer will be the height of the image obtainable; or, if the height of the object is divided by the height of the required image, and the result is multiplied by the focal length of the lens, the answer will be the distance the camera must be from the object. For example, to ascertain the height of the image obtained when a man 6 feet high is photographed at 9 feet, working with a lens of 4¼-inch focal length

$$72 \div \frac{108}{4\frac{1}{4}} = \text{approximately } 3 \text{ inches}$$

Height of the Camera

The effectiveness of an outdoor scene depends very largely upon the height of the camera. This directly controls the amount of foreground and sky included in the picture. Try this experiment for yourself with an average subject. Expose film No. 1 on the subject at about 18 inches from the ground, supporting the camera on one knee; expose film No. 2 with the camera in its normal position about the waistline; film No. 3 should be exposed with the top of the camera at eye-level, the subject being sighted from the center of the back of the camera between the two front corners or lens-board uprights. The height of the camera in photographing near objects is especially important with such subjects as a figure standing near a bush or shrubbery. Here a low viewpoint will give the figure greater height, while the eye-level or waistline-level view will often merge or dwarf the figure in relation to the nearby bush or shrubbery. Try a standing figure on an elevation with a background of sky and you will get a valuable lesson in this important detail.

Leveling the Camera

A very simple dodge which will help you to level your camera and so avoid the horizons that run up and down and slanting building lines in your pictures, is to rule a line horizontally across your ground-glass or the little mirror of the finder. If the camera is held so that the image of some point in the subject, which is on a level with the camera, falls on the line so ruled, we may be sure that the camera is level. To settle the position of the line, focus the camera on some building and rule the line across the finder along a prominent line in the building as indicated thereon.

Drill for Steadiness

You can quadruple your hand camera possibilities by persistent drill in the gentle art of holding the camera perfectly steady. Commonly it is advised that all exposures longer than 1-25th second should be made with the camera on a tripod or other support. But camera-holding drill will accomplish wonders, and many expert hand-camera workers are constantly giving exposures of 1-20th, 1-15th, and even 1-10th of a second without a tripod. Learn to hold your camera perfectly still—under one arm, or lightly pressed against the breastbone, or touching the eyebrow, or the side of the nose, or held against a door-post, tree or fence, post and the like. One-fifteenth second instead of 1-25th second means a vastly better negative for the majority of hand camera subjects where movement is not concerned. Of course this camera-holding drill should include the pressing of the shutter-lever with the finger without moving the camera.

Photographing Over a Crowd

When working in a crowd, as at automobile races or the like, it is often advantageous to be able to make your exposures with the camera held up over the head. This is not an easy thing to do successfully, but the knack can be had by preparatory drill. The results are worth the trouble and the ability to make exposures this way without movement, holding the camera well up above the head and looking up into the finder-mirror, will oftentimes give you a print that will bring a good price.

Releasing the Shutter

A very necessary item in camera drill is to learn how to hold the camera so that while the hand used to release the shutter supports and steadies the camera, a finger or thumb is free to press the lever releasing the shutter without any movement of the hand or the camera. The movement should be independent in the finger or thumb itself, and this independent movement can be made sure only by practice, the hand as a whole steadying the camera not only as to the weight and bulk of the latter but also as against the independent movement of the finger or thumb pressing the lever of the shutter.

Why Pictures Are Dull and Flat

The commonest fault in hand camera negatives is the general lack of clearness or brilliancy throughout the picture-image. This means soft, mushy negatives with veiled shadows and blunted definition throughout. The principal causes of these defects are: first, an excessive glare of light on the lens, which could be prevented by the use of a lens-shade even of the most modest dimensions; and, second, the flooding of the interior of the camera with extraneous light, resulting from the use of lens apertures very wide open or large apertures. This last results in the scattering of light from the surface of the lens and the interior of the camera all over the film. The defect is exaggerated if the lens is allowed to get clouded or dirty or is dull or finger-marked. Add a lens-shade to your equipment; don't use large apertures except when really necessary; see that your lens is clear and clean at all times; and then watch for the improvement in your negatives.

Why Pictures are not Sharp

The principal causes of unsharp hand camera pictures are three: (1) The subject moved during the exposure; (2) the camera was moved during the exposure; and (3) the subject was not properly focused. The technics of the photography of moving objects, that is, learning how to secure a sharply defined picture of an object which is moving during the exposure, need thoughtful consideration. This whole matter is fully explained in THE PHOTO-MINIATURE No. 161 "Sports and the Camera." Holding the camera still is simply a matter of practice and skill. Generally, the movement of the camera occurs when the lever of the shutter is pressed. Practise the operation of this movement with the tip of one finger, continuing until you can release the lever with the finger-tip without movement of any other portion of the hand or arm. (3) Correct focusing is largely a matter of estimating distances correctly and knowing the capacity of your lens for giving depth of definition, or depth of focus, as it is called. You can find this very fully detailed in THE PHOTO-MINIATURE No. 159, "Success with the Hand Camera."

Avoiding Under-Exposure

The biggest percentage of unsatisfactory negatives in hand camera work comes from under-exposure. The rule is "Give ample exposure to all subjects without motion, and the fullest permissible exposure to rapidly moving objects." Don't use the high shutter-speeds unless it is absolutely necessary. Always ask: How long an exposure can I give? Learn the relative exposure values of your stops or lens-apertures and use this knowledge to the fullest extent. If your stops are numbered 4, 8, 16, 32 and 64, remember that stop No. 8 admits just twice as much light in a given time as stop No. 16, and just half as much light in the same period as stop No. 4. Thus, suppose you are tempted to give an exposure of 1-50th second with stop No. 16, remember that you can give the subject four times as much exposure by simply moving your lens-aperture lever over to the figure 4, leaving the shutter-speed at 1-50th as before. Similarly, 1-100th second with stop No. 4, 1-50th second with stop No. 8, and 1-25th second with stop No. 16, all let the same amount of light reach the film in the same time. Stop value tables and depth of focus tables are given in THE PHOTO-MINIATURE No. 159.

Simplifying Exposure

You can simplify the problem of exposure for yourself by learning to classify your outdoor subjects. (1) The standard class in hand camera subjects is an open scene with prominent objects fairly near to the camera. This includes landscapes with a fairly strong foreground as distinguished from a landscape in which the masses of shadow nearest the camera are in the middle distance. And it includes street-views where the buildings are not exceptionally dark. (2) A second class is the "open landscape" class, which includes sky and clouds, the sea, open distant landscapes, and scenes with light foreground and without heavy masses of shadow in the middle distance. (3) Landscapes with extra dark foreground form another class, in which are included street-views with dark or heavy masses of shade, trees extending from near the camera, or a street-view consisting principally of a near view of a dark-colored building and a street-view with dark heavy figures or a group in the near foreground.

Taking the exposure for the standard subject as 1 second, then subjects in Class 2 will take approximately half that exposure, while subjects in Class 3 will take twice the standard exposure.

The 16-25 Rule

A handy rule in outdoor exposure is known as the sixteen-twenty-five rule. Here sixteen indicates the lens-aperture and twenty-five indicates the shutter-speed of 1-25th second; 16-25 is the normal exposure for an ordinary landscape with a principal object in the foreground, between May and September, from three hours after sunrise to three hours before sunset. Modify this rule as follows:

For a landscape with trees or bushes occupying most of the picture, double the exposure, viz., use stop *f*/11 (U. S. 8) and a shutter-speed of 1-25th second. For an outdoor portrait with the subject in the shade of the building but exposed to the unobstructed light of the sky, quadruple the exposure by using stop *f*/8 (U. S. 4), shutter-speed of 1-25th second. Subjects that are in the shade or days that are cloudy require exposures four times as long as those given above, the difference being based on the reduced actinic power of the light.

Doubling Exposures

There are two ways of doubling any given exposure: First, by halving the shutter-speed without changing the lens-aperture—for example, giving an exposure of 1-10th second instead of 1-25th second with the same stop. This, of course, depends very largely upon the accuracy of the shutter-speeds, about which perhaps the less said the better. Second, by doubling the area of the lens-aperture without changing the shutter-speed—for example, using stop *f*/11 (U. S. 8) instead of *f*/16 (U. S. 16), keeping the shutter-speed unchanged. The second is the better method and will often permit a snapshot to be made when the sun is shining, with the camera held in the hands, which will be impossible with the first method. This tip is especially useful when using color-filters.

Exposure with Portrait Attachment

Contrary to the rule that to obtain large images of nearby objects the normal exposure required by such subjects should be increased four times, no increase of the normal exposure is required when the Kodak portrait attachment is used for this purpose. Give the exposure that would be correct for the subject without the portrait attachment, and you will find it practically correct. This should prove a very valuable tip when using the portrait attachment for photographing flowers, butterflies and the like, and other small objects at close range out-of-doors.

How to Count Seconds

The average hand camera worker uses the tripod so rarely that when he has a subject calling for several seconds' exposure he is generally at a loss to know how to accurately time the exposure. The simplest way to count seconds accurately is to repeat some phrase which requires one second for its clear enunciation, as for example, the phrase "one hundred and one." The last word of the sentence should always indicate the number of seconds that have been counted. Four seconds, for example, should be counted: one hundred and one, one hundred and two, one hundred and three, one hundred and four. Exposures longer than four seconds can be best timed with a watch.

Learn What to Leave Out

The first step in the way of making pictures instead of mere snapshots out-of-doors is to think what you can leave out of the scene before you make your exposure. The average snapshot includes far too much of the subject in front of the lens. Prove this to yourself by going over a few of your outdoor negatives, and see whether there is not a little bit in almost every negative which would make a more interesting picture or one more "worth while," if all the rest of the film were trimmed away. You can emphasize this lesson by enlarging an average dozen of your outdoor negatives to one uniform size. Looking carefully over the enlargements, you will see quite plainly that they all need or will stand a good deal of trimming or cutting away, so as to emphasize or give more prominence to the chief interest in the scene.

Avoid Wide-Range Views

The average landscape, as seen by the eye, is chiefly interesting or beautiful by reason of its large masses of color contrast, its bigness or sense of space, and the variety it presents in form and light and shade. To portray such a scene within the narrow limits of the average hand camera size, 3¼ x 5½ or smaller, losing all the sense of space and color, and rendering the subtle harmony of nature's color contrasts by inharmonious contrasts of light and shadow, will usually result in a maplike record lacking charm and interest. It cannot be otherwise in the great majority of instances. Natural scenes embracing a wide expanse rarely lend themselves to the making of small reproductions possessing pictorial interest. Leave them to the panoramist and learn to see pictures in the little bits of nature on every hand. You can learn this lesson from a careful survey of the pictures shown at any exhibition.

Landscape with Stream

To photograph an open landscape with a running stream in the foreground, so that the surface of the stream will really look limpid and flowing, is not an easy task. Under normal conditions the exposure should not exceed 1-10th second. Sometimes such an exposure is possible even with a panchromatic plate and K1 screen. For a landscape with a fairly heavy foreground of yellowish green foliage, the only way to get pleasing color values in the landscape and clouds in the sky (if there are any) is to use a tripod, wait patiently until there is no movement in the foliage, and give an exposure of 2 seconds with a panchromatic plate or film and K3 screen.

Photographing Ravines or Glens

Don't attempt an instantaneous photograph or snapshot of a ravine or glen, even when the sun is shining. The result is bound to be a failure. Use a tripod and give it a time exposure with a small lens-aperture, to get depth and relief, the characteristic features of such a subject. Try to get the light falling more upon one side of the subject than upon the other, not directly through the center. With a fairly clear, bright day and the lens working at *f*/22 try an exposure of 30 seconds. Such subjects should always be photographed in the early forenoon or late afternoon when the light falls from a low angle. Where the light comes almost entirely from above, a longer exposure, say 35 seconds, may be required.

Lake Views A lake generally means a fairly large expanse of calm surface water. We may or may not have it surrounded by hills. But while skylight may be cut off by the hills, yet we have the reflecting effect of the water surface. Pictures wherein lakes, large ponds, wide-open rivers, and other large masses of water occupy any considerable part of the foreground division of the picture are among the cases which call for very great care and circumspection as regards point of view. Meanwhile the hand camera man may be wise in accepting a word or two of general advice. (1) Do not let the lake or other open water extend from one side of your picture to the other. (2) Do not have much picture space occupied by calm water. (3) Avoid bright patches of water close to dark rocks, tree trunks, etc.; such strongly marked contrasts of light and shade are not likely to be very pictorial. If the edge of the lake is fringed with heavy foliage, remember the rule to expose for the shadows and let the high lights come as they will.

Birds' Nests An attractive outdoor subject, in which the amateur generally fails, is the photographing of birds' nests. Contrary to common belief, this subject is one which calls for a long exposure and a small stop. First, carefully fix the camera by tying it to a nearby branch or other vantage-spot giving a pleasing view of the nest and its possible contents. Stop the lens down to *f*/16 to secure detail and give an exposure of from 1 to 3 seconds carefully counted. You may have to wait half an hour in order to secure perfect stillness, that is, freedom from wind-movement or the swinging of the branch carrying the camera. Of course, a portrait attachment will generally be used on the hand camera for such a subject as this. If there are young birds in the nest, then it must be well lighted, as the exposure cannot exceed 1-5th second with the lens wide open without risk of blur or movement.

Beach Views A straight-edged sea, whether the straight edge be the horizon or the inshore surf, is rarely pictorial. The curved line of a bay, or the view along the beach giving the oftentimes wonderfully beautiful curving lines of foam-flecked water, are more interesting. If possible, include a glimpse of distant sand-dunes or cliffs or outjutting neck of land. If the composition needs a dark spot in the foreground to balance it, place a bit of washed-up timber or a pile of seaweed at the right spot and so secure the dark mass required. The sky plays an important part in such pictures.

Including too Much Subject

In photographing at the seashore remember that the average beach scene suffers from the inclusion of too many scattered figures, giving a distressing sense of disconnection. Pictures of small groups are always more interesting; but beware of the conflicting interests of two such groups in one picture.

Children Paddling

In making snapshots of children paddling at the edge of the surf on the beach, the best effects are obtained by holding the camera at eye-level. This gives a fairly high horizon-line, desirable when the sky is bare and cloudless, natural perspective effects as far as the figures are concerned, and a better line to the swirl of the incoming tide on the beach itself.

Cloud Pictures

For obtaining cloud pictures without foreground there are two methods: the use of ordinary plates or films without a color filter, giving short exposures and developing slowly in a diluted developer; or using a color corrected plate or film with a filter, giving longer exposures and normal development. The latter method is the better of the two although more bothersome and generally involving the use of a tripod. By the first method the exposures will range from 1-50th second for bright clouds over the sea to 1-10th second (tripod) for a heavy sky on a dull day. Lens-aperture *f*/22 (U. S. 32). On a fairly bright day between 7 and 10 A.M. and 4 and 6 P.M., in May, June, July, with a clear atmosphere, 1-25th second will usually give a good negative. Wherever there is color, as in the early morning, or during the day where fleecy white clouds come against a pale blue sky, the second method should be employed with a tripod. Here the exposure will vary according to the multiplying factor of the color-screen used. With a Kodak color-screen and speed films and generally favorable conditions as at the seashore or from a mountain top, the exposures will range from 1-10th second to 1 second, according as the day is bright or dull. Wherever a color-screen is used, the exposure should be increased and the normal tank development employed. When the sunlight is yellow in the late afternoon, summer and autumn, no filter is required and exposures of 1-20th second at *f*/16 (U. S. 16) or *f*/11 (U. S. 8) should prove ample for the hour before sunset. But beware of under exposure.

When to Use a Sky-Filter

When you have a summer landscape of which a large expanse of sky filled with fleecy white clouds is the chief glory, or a snowscape in which a foreground brilliantly flecked with sunlight and shadow is the principal feature, you can secure vast improvement in your negatives by the use of a sky-filter. This is a European invention latterly introduced on this side. It is a disc of plane or flatted glass, the upper half of which is gradated in tint from a middle yellow to almost clear glass, the lower half being simply clear glass. Used in landscape photography where we generally have to deal with a dark foreground, this filter gives a longer exposure to the foreground (which requires it) than to the sky. In photographing the snowscape, of course, the position of the filter should be reversed so that the shaded portion veils the lower half of the lens and so prevents the foreground of the picture from being over-exposed, while giving more time to the sky, which in such subjects is relatively darker than sunlit snow.

Exposure with a Color Filter

The multiplying factor of a color-filter expresses the number of times the normal exposure (without a filter) must be increased when a filter is used. The basis used by the maker of the filter in calculating his multiplying factor should be known. The general aim of the maker of filters for average hand camera use is to give a factor which will yield detail in the shadows of the average outdoor subject. For example, the Kodak color-filter is said to have a factor of 3. But this is meant for average use in photographing landscapes with clouds and sky. When it is a question of photographing a dark-colored nearby object, as when flowers are photographed at close range, the exposure with this 3-times filter should be increased to 10 times normal, the multiplying factor of that filter for such a subject being practically 10.

Figures in Street-Views

Many street subjects are spoiled by the figures which are included. It is certainly wiser to err on the side of too few than too many figures. But one need not therefore fly to the extreme of no figures at all, which is apt to give a "deserted village" appearance. Most street-scenes show one or other of the following undesirable features: (1) Figures staring at the camera; (2) too many figures disconnected or in a large number of small groups, between which there is no apparent relation; (4) near figures too large for the proportion of the picture; (5) near figures and distant figures showing very marked difference of size, suggesting exaggerated proportions.

Awkward Conjunctions

In street work look out for awkward conjunctions of forms, such as a lamp-post or electric light standard in the middle distance, apparently resting on the head of a prominent figure in the view. This applies also in outdoor portraiture. Watch carefully the shapes of things behind the figure. I recall a delightful portrait of a girl, seated on a boulder on a hillside, with a group of fuzzy bushes or shrubs sprouting from the top of the girl's head—at least so it seemed.

Figure Work Out-of-Doors

The common error is to attempt to get large figures in outdoor portraits. It is better to get a good result on a small scale than a faulty figure picture on a large scale. You can always enlarge the small figure or group if it is worth enlargement. Remember that the nearer the figure is to the camera, the larger its image is on the plate and the longer is the exposure required. In outdoor figure work including movement, the nearer the figure, the greater is its apparent movement on the film during the exposure, and so the greater risk is there of blur in the picture or under-exposure if it is attempted to shorten the exposure in order to "stop" the movement of the subject on the film.

Harbor Scenes

Sailboats, fishing- or lobster-boats and small shipping such as are found in most harbors at seashore resorts offer simple subjects for the hand camera. Here the subject is generally some little distance away from the camera, so that we can focus for infinity and feel pretty confident that the picture will be sharp all over with the full aperture of the lens. The subject is naturally a light one, heavy shadows in the foreground are almost sure to be absent. Moreover, although the vessels may be moving rapidly, they are sure to be at such a distance that the movement of the image on the plate is not rapid, so that an exposure of 1-25th second may be given without fear of blurring. In fact, with subjects of this kind, the movement is so slight that it hardly has to be taken into consideration at all; one may be governed by the requirements of the subject from the viewpoint of general illumination, composition and sky.

Yachts at Rest

Harbor scenes, with yachts riding at their stations in well-balanced groups, are very pleasing if treated pictorially. The lighting of the scene is here a detail of importance, the late afternoon or early morning, when the sun is not high, giving the most desirable effects. In such circumstances, a fast ortho plate and color-screen, with an ample exposure and a small lens opening, will generally produce a more interesting result than a "snapshot." Care should be taken that the point of sight is not too high, about 8 feet from the water being right, unless foreground water effects with reflections are desirable. In all marine photography, where the illumination is apt to be very intense and reflected light is a difficulty, the use of a lens-hood is necessary and, apart from its advantage in preventing light-fog, it will serve to protect the lens from spray.

For Quick Work

When photographing yachts or sail boat races from another boat, quickness in finding and following the subject is the prime consideration. For such work the full-size, direct-vision open-wire finder has no equal and offers the greatest freedom of movement. With such a finder and lens working at 1-50th second there is little chance of failure.

Sports

In photographing the finish of a foot-race or any form of sport where the principal subject has to approach and pass a given point or line, the camera is usually focused beforehand on this point or line, and the photographer waits to make his exposure just as the moving object touches the line. In such cases a successful picture depends on the photographer's anticipation of the correct moment for the exposure. It must be at least 1-10th second before the object reaches the line or the result will show the object well past the line owing to the delay in releasing the shutter.

Pictures of Animals

A whistle is often a very big help in photographing animals, whether in the open country or in the zoölogical park. Get everything ready for your exposure and then give a quick blow on the whistle, and you will get that alert look which is so desirable in pictures of this sort.

Two Handy Rules

The pictorial value of your outdoor work can be directly increased by simply remembering these two rules and following them as closely as the subject will permit. First, avoid light spots at or near the margins of the view; try to get the highest spot of light a little to either side of the center of the picture space. Second, wherever it is possible choose a viewpoint which will give you almost equal amounts of light and dark distributed through the picture-space. Mentally divide the picture-space by a diagonal line from the upper right to the lower left corner. Let the predominant dark masses be in the right-hand diagonal and the dominant light-masses in the upper diagonal. A dark spot at the lower left-hand corner will usually complete the balance of a composition so arranged.

The Unusual Aspect

"Out-of-doors with the hand camera" becomes vastly more interesting in the doing and in the results if the reader will keep his eye open for the unusual aspect of the common-place subject. Take, for example, a valley stream. It may be that by climbing a few hundred feet you can get a bit of jutting foreground, below which the stream will wind in curious curves in the valley below. Or take the summer girl on vacation. Instead of picturing her on the steps of the porch, or against an old wooden gate, or looking coy against a background of shrubbery, select a bit of high or rising meadow ground, let her pose carelessly for the standing figure, go back about 15 feet and kneel, resting the camera on one knee pointed at the girl. Select the viewpoint so that the figure will stand out against the sky as if on a mountain top. If the figure is outlined against a low setting sun, so much the better. Rest the camera easily and give an exposure of at least 1 second at *f*/8 (U. S. 4). The unusual does not mean the startling or bizarre.

Bridges and Streams

The bridges crossing small country streams, although often presenting pictorial value, seem to escape the hand camerist. Carefully handled, such a subject can be made to give a picture worth while. In portraying such a scene, the amateur should bring all his knowledge of composition into play, dividing his picture-space so that the right amount of sky, the position of the bridge with its shadow and the run of the stream with the strip of foreground all combine to give interest and charm to the view. In some cases a figure on or near the bridge will add life and interest, but this detail will call for special care that the figure is not obtrusive or too obviously posed for the occasion. Under average conditions of a bright day with clouds, an exposure of 1-10th second with the lens at *f*/8 should give a pleasing negative. If the reader has any doubt of his ability to hold the camera in the hand for such an exposure, prop the camera on a nearby fence or gate or wall or other support, or use a tripod, stop the lens down to *f*/16 and give it ½ second exposure.

If the stream be of the meadow variety, meandering with many curves over a stony bed, it may be well to try an exposure at some carefully selected point of vantage. The late afternoon is the best time for such a subject and, if the motion of the water is evident, the exposure should not exceed 1-10th second, with the lens at *f*/8 (U. S. 4).

Against the Sun

Among the most pictorial of woodland opportunities are pictures made along a woodland path with the sun streaming in from above, as at 11 A.M. or 2 P.M. In such a scene we have extremes of light and dark, which means a full exposure to get sufficient detail in the darker shadows. The view should be taken against the light, a lens-shade being employed if sunlight reaches the camera. Focus sharply upon a tree in the middle distance, but let the balance of the picture be softly defined. Avoid critically sharp definition all over the plate or the view will have no interest save as a record. The exposure must be made with a tripod and will rarely be less than 1 second and generally 2 or 3 seconds, with the lens at *f*/8. If the illumination and focusing are carefully handled, the scene should be pleasingly plastic as to its definition, rendering the effects of light and shade in masses rather than sharply defined forms with excessive detail.

Landscape and Water

A familiar vacation subject is the summer boarding-house or farmhouse, a little way from the shores of a small lake and more or less surrounded by trees. To get a pleasing picture of such a scene, look first to its proper illumination, that is, be careful to choose the time of day when the sun gives the house pleasing relief and the light and shade effects are harmonious. The view may be taken from across the lake if it be narrow, which will give the advantage of nearby reeds or bushes or trees as a foreground screen, or from a boat on the lake at such a distance as will give the house its proper setting in the scene. If the view is attempted before 9 A.M. or after 3 P.M. with a bright light, an exposure of 1-25th second with the lens at *f*/8 (U. S. 4) should get detail in the shadows of the tree masses and give life and sparkle to the surface of the lake in the immediate foreground of the scene. A half-second exposure at *f*/16, using a tripod at the shore opposite the house, will give a more satisfactory rendering if this method can be followed.

The Summer-House Out-of-Doors A favorite summer subject is the garden-house found in so many gardens nowadays. Such a house forms a delightful background or setting for single figures or groups in light clothing. But the brightness of the day often misleads the photographer, and his films are accordingly very much under-exposed by reason of the nearness and dark color of the garden-house, which is usually covered with green shrubbery or vines. Supposing the scene to be photographed in the late afternoon or in the early morning, when the shadows are long, an exposure of 1-5th second at *f*/8 will be necessary instead of the usual 1-25th second which seems to be given to such subjects. This means a tripod. If a light yellow color-screen is used, which may be advisable, then the exposure should be 1 second.

Camp Scene Including Oneself With a very little preliminary trouble it is quite practicable to make an interesting picture of a camp tent, with figures, including oneself, seated at a meal or otherwise conveniently disposed, in front of the tent. First get a friend to seat himself in front of the tent, setting a chair or camp-stool nearby for yourself. Focus the scene carefully, including the tent and its background, and then drive a post at the point from which you have focused the scene. If you can get your focus from a nearby tree in front, so much the better. The camera is next tied securely to the post or to the tree at the point from which the picture was arranged and focused. The lens and shutter are set for an exposure of 1 second with *f*/22 (U. S. 32), and a sufficient length of thin string is tied to the shutter release and led into the foreground of the scene up to the seat you propose to occupy in the picture. Everything being ready for the exposure, take your seat and, placing one foot lightly over the string attached to the shutter, pull the string gently at the right moment, release the shutter, and make the exposure. If a little skill is used, this device will give a pleasing picture without mishap or failure. The light should come from behind the tent but without sunlight reaching the lens. If the figures in front of the tent are seated at the table, as at a meal, a game of cards, or some other diversion, the hand pulling the shutter release may be hidden behind or under the table, thus hiding any trace of movement at the moment of exposure. If the light conditions are right for the full second exposure, this should give a thoroughly good negative with details in the shadows of the scene.

Campfires The pictures of campfires with groups of happy holiday seekers around them, which one sees now and again in the amateur's album, are generally secured with the aid of a charge of flashlight powder, thrown into the center of the wood-fire at the right moment by an assistant. The flashlight so used should be pure magnesium powder and not a compound. For a pleasing composition, focus the scene and group carefully by means of the focusing-scale on the camera and put the film ready for exposure. If the night is very dark, the shutter may be opened for a time exposure, the final details quickly settled, and the flash of powder thrown into the fire. This will complete the exposure in from 5 to 15 seconds. The members of the group should be warned to sit or stand perfectly still and not more than one or two should be permitted directly to face the camera, or the flash will produce weird facial expressions.

Sports The following typical exposures may be helpful in photographing outdoor sports with the hand camera, which is supposed to be fitted with a shutter working up to 1-300th second. The subjects are in all cases supposed to be coming toward the camera at an angle of about 45 degrees. Men walking briskly or children playing, 1-40th second; ordinary cycling, 1-100th second; men running or jumping, 1-150th second; horses galloping or ponies trotting, 1-200th second. For the slow movements of most outdoor games, an exposure of 1-300th second at *f*/8 will usually give a sharp picture, but success here obviously depends upon the choice of the moment of exposure, the more rapid movements being avoided. This is based on a working distance of 50 feet; if at 100 feet, halve these exposures or use a smaller lens aperture.

Views from a Train Photographing from a train, steamer, or other moving object is not altogether easy, but by watching for a favorable moment some very interesting records of a journey may be obtained in this way. Do not attempt to photograph any subject within 100 feet of the camera. Set the pointer of the focusing-scale at the 100-feet mark and the shutter at 1-50th second with the lens at *f*/16 (U. S. 16). A bright or sunlit day is presupposed. Rest the camera securely on the ledge of the car window if in a train, or balance yourself securely on both feet if on the deck of a steamer, and as the train rounds a curve or passes a picturesque bend in the river or slows up in going over a viaduct, which givs a view worth while, release the exposure shutter. An angle of about 30 degrees to the train's direction, preferably pointing back, should be chosen for the camera. Success will depend chiefly upon the combination of a favorable lighting of the subject, choice of viewpoint, and quickness and certainty of manipulation at the right moment. In photographing from steamers, remember that the exposure must be very much more rapid for another steamer moving at right angles than where the steamer is photographed as it approaches or leaves the boat you are working from. The best time of day for this sort of work is always between 3 and 4.30 P.M.

Buildings Most amateurs seem to be uncon-cious of the fact that the aspect of any building changes materially from hour to hour of the day. At one time its architectural features will stand out in pleasing relief; at another time the building will look flat and lifeless. Do not photograph a building which is either wholly in sunlight or wholly in shadow, but choose that viewpoint which which will give you the widest possible variation from sunlight to shadow. Where the most attractive side of a building faces north, it may be photographed to best advantage in springtime. This applies with equal force to a building which faces south but is screened by trees from the afternoon sun. Early morning and late afternoon are the most favorable times for photographing buildings, because then the shadows are longer.

Exposure for Buildings For a light-colored building in sunlight an exposure of 1-25th second with the lens at *f*/11 (U. S. 8) will give a good negative between 6 and 8 in the morning and 5 and 6 in the afternoon, during the months of May and June. In February and October these exposures should be doubled, other conditions remaining the same. If the building is dark in color, give the same exposure but open the lens to *f*/8 (U. S. 4) at all the times mentioned. Whenever the subject calls for an exposure longer than 1-25th second, use a tripod or secure some support for the camera. Do not be deceived by light yellow brick buildings. They demand full exposures.

A Single Building In photographing a single building in a city street, avoid the common error of attempting to get it on the upright way of the plate from a near viewpoint, with a view to excluding the surrounding buildings. This usually necessitates tilting the camera upward to get the top of the building in the picture, which results in converging lines. It is better to take a more distant viewpoint and get the building well centered on the long way of the plate, with the proper proportion of foreground and a bit of sky showing above the top. Any portion of the view not desired can easily be cut away in trimming the prints.

Sunlight Effects Very effective snapshots can be had in summertime by photographing details of houses or buildings when these are flecked with patches of bright sunlight and shadow. Oftentimes a doorway or window or the front of a house or public building or a bit of a cornice will give an attractive subject of this sort. The exposure will depend upon the amount of light the shadows reflect, as the shadows will usually occupy more space in the picture than the sun-lighted parts. The most effective shadows are found early in the morning or late in the afternoon. This means tripod exposures ranging from 1-5th to 1-10th second with stop *f*/22 (U. S. 32). Pictures of this sort are obtained just as surely with the $2 box camera as with the most expensive folding camera and anastigmat.

Twilight Possibilities

A fascinating field of outdoor photography, which is almost wholly neglected despite its wonderful possibilities, may be found in the streets and small parks of our cities at twilight, or around the country home just after sundown. The time available for such work—the last few minutes of daylight and the first glimmer of the night lights—is necessarily short, so that the possible subjects within a given area should be known and carefully studied before the actual camera excursion. A tripod will be needed, as the exposures will range from 3 to 10 minutes, even with a fast lens and a rapid ortho-plate or film. If it is possible to work from the shelter of a doorway, or from a window not too high above the street (but sufficiently high to avoid the inclusion on the plate of passersby), such a viewpoint is advantageous, as obviating the inconvenience of a curious crowd about the camera. In pictures of twilight scenes, as a matter of course, there will be a general absence of detail, and the subject chosen should be one which lends itself to pleasing interpretation by broad and large effects of darks and halftone. In some instances,the lines and projections of a building or an arch in the immediate foreground of a town scene, or the trees about the country house, may be used to inclose the object of chief interest, just as the dark proscenium arch of the theater frames and enhances the pictorial value of a stage setting. Oftentimes the effects of dusk can be emphasized by a double exposure made, without moving the camera, just before the last gleams of daylight fade, and again as the first lights of the streets and buildings begin to appear. A good skyline, rendered in soft silhouette, will also add to the charm of the carefully chosen twilight subject. Ample exposure is essential in work of this class, under-exposure destroying all the subtleties which make for pictorial effect.

Rainy Day Street Views

The best rainy day pictures in city streets are obtained when the sun bursts forth as the rain ceases. This touch of sunlight gives glint and brilliancy with attractive reflections. Oftentimes a porch or awning will give the necessary shelter, or an open window or doorway can be utilized, or one can go out into the rain, holding an umbrella pressed against the body with one arm, leaving both hands free for the camera. One twenty-fifth second with the lens at *f*/8 (U. S. 4) will give a good negative if the sunlight is fairly strong (not too late in the afternoon). Otherwise the light is weaker when the rain is falling and a tripod exposure of 1-10th second may be necessary.

Electric Light Silhouettes

When buildings are outlined with electric lights for town festivals or at summer or seashore resorts or expositions, very effective silhouette pictures can be obtained showing the buildings brightly outlined by light but wholly without other detail. This calls for a tripod. A 3-second exposure at *f*/11 (U. S. 8) will give the outline crisp and brilliant without halation or over-exposure. If a tripod is not available it is generally possible to set the camera on the top of a mail-box or other convenient support.

Firework Displays

To photograph fireworks or pyrotechnic displays, set the camera, loaded with plate or film and pointed at the expected display, on a firm support at a favorable viewpoint, and open the shutter just before the illumination is expected, closing it as quickly as the display has ended. This, of course, will show movement and record the flying light in infinitely varied curves and streaks. To get a sharp picture of a particular display, set the lens at its largest aperture and try an exposure of 1-25th second. In this case the exposure must be made at the moment when the display is at its best, which is practically at the end of its movement and just before its vanishing. Be careful that no strong lights such as electric arcs and the like come within the field of view included by the lens as these will mar the effect.

Moonlight Views

It is quite possible to make photographs outdoors by moonlight. In fact, if the moon itself be not included in the view, the street-scene made at the full of the moon on a clear night, with a correct exposure, can hardly be told from a daylight view. Effective moonlight views may be obtained in wintertime when the ground is covered with newly fallen snow, the exposures in such cases ranging from 25 to 40 minutes with the lens at *f*/8 (U. S. 4). But the most attractive "moonlight" pictures are those made at sunset, when the sun sets slowly over a sheet of water screened by nearby foliage, the sky being filled with dark clouds tipped, of course, with light. For such pictures *f*/32 is used, and the exposure should be 1-10th second.

Photographs of Lightning

The best pictures of lightning displays are made when the night is unusually dark and the lightning is unaccompanied by rain. Set the camera, loaded with film, at an open window facing that part of the sky from which the flashes of lightning are seen to appear. An advantageous position being thus chosen, the shutter is opened as for a time exposure. As soon as the flash has occurred the shutter is closed and another plate or section or film placed ready for another exposure. The lens can be opened to *f*/11 or U. S. No. 8. Unusual lightning effects may sometimes be had by attempting an instantaneous exposure, of, say, 1-25th of a second while the flash is in progress; or by leaving the shutter open after a flash and letting a second flash be recorded upon the same film.

Avoid Cloudy Days in Winter

A cloudy day after a heavy fall of snow is about the most unfavorable time for winter work out-of-doors. Either there will be no shadows or the shadows will be weak and flat, and the lack of detail in the snow will add to the desolateness of the scene and suggest the dreary side of winter. Wait for a glint of sunshine or get some shadows into the composition to brighten up the general effect of the scene.

Winter Landscapes

Pictures of snowclad landscapes, with houses, groups of bushes or brooks, or with figures (without movement), can be made with any hand camera between the hours of 10 and 3, with 1-25th second exposure at stop *f*/16 or 1-5th second exposure at stop *f*/32. If nearby and distant objects are to be reasonably in focus, use the smaller stop and set the pointer at 25 feet on the focusing-scale of the camera.

Winter Foregrounds

In most snowscapes the blank foreground of white snow robs the picture of half its charm. Whether the sun is behind or in front or at one side of the camera, this effect can be remedied by the choice of a viewpoint which will give a pictorial arrangement of shadows of nearby trees or similar objects slanting across the otherwise blank foreground of white snow.

The common device of breaking up a blank foreground by trampling through the snow, thus making some sort of path or track, has been overdone and should be avoided wherever possible.

Home Interiors

In arranging a small room for interior photography, adjust the furniture so as to show an unbroken distance of floor from the camera to the far end of the room. This can be done without disturbing the natural appearance of the room in everyday use. If there should be a wide window brilliantly illuminated at the far end of the room, this should be screened during the first three-quarters of the exposure. Red flannel lightly tacked to the window-frames is the best screen, but sometimes a fairly heavy yellow netting or muslin will sufficiently soften the illumination. Always show more of the floor than of the ceiling and be sure that your camera is properly squared with the uprights of the room, and beware of reflections in mirrors or glazed pictures hanging on the walls. A day when the sky is filled with white clouds, without sunlight, is the most favorable for interior work.

Chief Faults in Interior Work

Under-exposure and uneven illumination are the two bugbears in interior photography. To avoid the first defect, use a tripod and give a full or slightly over-exposure, controlling the density or strength of the negative by diluted development for a longer time than usual. The second defect is best prevented by care and patient skill in adjusting the light sources of the interior, that is, by raising or lowering or screening windows, by opening or closing doors, or, in an extreme instance, by the use of small charges of flash-powder locally to illuminate a dark corner.

Lighting Dark Corners

Local illumination will do wonders in photographing a difficult interior where the colors are heavy and the natural lighting of the room produces strong contrasts of light and dark. Use a small lens-aperture, which means a prolonged exposure, and then during the long exposure ignite 2 or 3 inches of magnesium ribbon over a tin dustpan, behind any convenient piece of furniture, in such a way as to throw the local illumination just where it is needed to lighten the shadow masses.

Shadows and Contrasts

The heavy shadows and strong contrasts which mar so many pictures of interiors—especially home interiors of small rooms—can be remedied by giving an exposure long enough to record the detail in all but the darkest shadow masses which will generally occupy but a small area in the picture. Color is an important factor in the average interior. Dark, heavy colors simply require more exposure. Adjust the sources of light so as to give harmonious or pleasing illumination and then be sure to give a generous exposure. A thin, detailful negative will always give a more satisfactory print than a hard, contrasty negative.

Portraits Indoors

It is possible to make a snapshot portrait indoors, that is, with the camera held in the hand, only on the brightest day with sunlight streaming through a carefully screened window and a subject in light-colored or white costume placed quite near to the window. Another possible subject under these conditions is a single figure or group of two semi-silhouetted against the light in a doorway. It is better to connect the figure or figures with one side of the doorway in such a case, to prevent a too obtrusive division of the contrasts. Apart from these two possibilities, all interior work needs a tripod or other support for the camera during the exposure.

Advantages of Enlarging

Instead of making straight prints from your summer negatives this year, look carefully over your negatives and see whether you could not obtain a larger percentage of more interesting pictures than usual by enlarging only portions of each negative, thus leaving out or eliminating the uninteresting portions of a scene. Enlarging is simply another way of printing, and with the fixed-focus enlarging-boxes now obtainable is a simple and inexpensive way of getting better results than by merely making contact prints in a printing-frame.

Simplicity of Enlarging

The average amateur does not sufficiently appreciate the extreme simplicity of the process of making enlarged prints from his little negatives. In using a fixed-focus enlarging-box, the negative is placed in one end of the box, the developing paper in the other end, the negative end of the camera is exposed to the sky for a few minutes and the print is developed. As compared with contact printing, the only difference is that in one case the paper is in actual contact with the negative and in the other it is separated by a space of some inches. The developing, fixing and washing the print is the same in both cases. An enlarging-box can be bought for a few dollars or made at home, with even less expense, by following the instructions given in The Photo-Miniature No. 158, "Photographic Apparatus."

BOOKS

The following numbers of The Photo-Miniature Series are crowded with information for the hand camerist: Hand Camera Work (Nos. 3 and 107); Street Photography (No. 14); Photographing Clouds (No. 24); Seashore Photography (No. 28); Photographing Animals (No. 39); Aërial Photography (No. 52); Pictorial Principles (No. 53); Vacation Photography (No. 62); Marine and Surf Photography (No. 71); The Hand Camera (No. 76); Focal Plane Photography (No. 77); Outdoor Photography (No. 81); Photographing Outdoor Sports (Nos. 91 and 161); Photography with Small Cameras (No. 97); Reflex Cameras (Nos. 99 and 151); Outdoors with the Camera (No. 117); Pocket Camera Photography (Nos. 125 and 146); Correct Exposure (No. 105); Photography for the Press (No. 124); Simplified Photography (No. 131); Getting Results with your Hand Camera (Nos. 132 and 159); Landscape Photography (Nos. 25 and 160); Photography in Winter (Nos. 57 and 155); Travel and the Camera (No. 138).

Amateur Photography in Time of War

In answer to letters asking for specific instructions or ficial regulations governing the use of cameras by nateurs and others out-of-doors, now that our country at war, I am advised by the Secretary of War that ie "making of photographs of objects not of military nportance is not objected to by the War Department." his is not very specific but would seem to indicate iat no regulations as to the use of the camera out-of-oors have as yet been officially promulgated by the overnment.

The Adjutant General of the Eastern Department . S. A., Governors Island, New York City, writing nder date June 19, 1917, says: "The privilege of taking hotographs at military posts is subject to the superision of post commanders."

"We have troops guarding bridges, railroads, etc., nd while we have issued no special instructions about aking photographs, it would be just as well not to take hotographs where the troops are, because the motive night not be understood, although if the purpose were xplained to the local commanding officer beforehand do not imagine that there would be any trouble. There have been cases where innocent persons have aken photographs and have been arrested."

This letter plainly indicates that photographers hould not use their cameras out-of-doors in the vicinity f military posts or at or near armories, bridges, railoads, or other places under military guard or control. Any further information I can obtain will be published n these pages.

The Espionage Law recently enacted by Congress ias been approved by the President and has become a aw. Briefly, it forbids the copying or taking, or obtaining, or transmitting to any agent of a foreign government, of any photographic negative, sketch, photograph, etc., of any place or thing in any way related to the national defence. The Act is specific and comprehensive in its details, and gives summary jurisdiction to the local authorities acting for the Government to control the outdoor activities of amateur photographers within the areas under their control as they may see fit.

The few instances of arrests of amateurs using their cameras within prohibited areas or instances of interference with the use of the camera by local officials seem to be the outcome of purely local regulations in the exercise of the police power of the state or municipalities. In the face of all which the amateur may safely photograph outdoors to his heart's content so long as he carefully avoids the vicinity of any place guarded, used or controlled by the military or for military purposes. In case of any doubt, a word with the officer in charge at any given point will always be the surest way of avoiding trouble.

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A Magazine of Photographic Information

EDITED BY JOHN A. TENNANT

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Making Money With the Camera

Without a doubt this is going to be one of the most interesting numbers thus far published in The Photo-Miniature Series, because it is wholly concerned with the making of what a saintly nun once gravely declared to me is "next to the grace of God"—to wit: money. And, going as it were suddenly from grave to gay, I say it is certain that we have here a Dream Book more interesting than any other dream book ever published, simply because the dreams herein set forth were dreamed by men and women of our own time and made to come true. So that you, gentle reader, may safely revel in these dreams and work them out during the coming days to your own profit. Photography is in its youth, and youth is the time for dreams. Not yet has it reached the fulness of its growth and development in the work of the great world. There is still chance and opportunity for the profitable working out of many ideas which, at first glimpse, seem to show but the unsubstantial fabric of a dream. In the following pages I purpose to set before you some of the many ideas which others have turned into money by the use of the camera. Some of these dreamers were amateurs, with but scanty equipment of tools or skill; others were professional workers whose dreaming led them along new byways into an unsuspected gold country. What another has done, that you may be able to do. Make no mistake in the beginning. Idle dreams lead nowhere. There must be work behind the dream. If you set out to turn any of these dreams or ideas into money, you must prepare for serious work, and you must put the work right behind the idea, with abundance of good faith in the idea and in your work. Some of the ideas and methods herein are well within the capacity of the amateur with a hand camera, and offer a means of making money with the camera in such spare hours as the amateur has. Others show how he may turn the photographic material he already has into money, or direct his future activities into money making lines. Other ways are shown by which the amateur or professional can specialize in some particular way which offers an opening to a new and profitable field. And, finally, several sidelines or specialties are dealt with as offering opportunities for increasing the photographer's normal yearly income, or suggesting new ways by which, without increasing his overhead expense, he may add to his volume of business.

Ideas and Methods

Every idea, plan, or method given has been proven in actual experience. They are dreams which have come true—in most instances under the writer's personal observation during these last few years. Necessarily, because the detailing of working methods calls for lengthy description and because the methods must vary according to the personality and circumstances of the individual worker putting them into actual practice, I make no attempt to give the working methods, but content myself with the suggestion of the idea and its content. The methods have all been published in one place or another. A great many of them can be found in the different numbers of The Photo-Miniature Series. I have referred to the sources of information wherever this seemed desirable. This has necessitated reference to many books now out of print. I cannot help this. The information was published. If it is not now instantly gettable, be assured that it is worth seeking for and can be found by earnest effort.

Photographs for Publication

The making and selling of photographs for use in the illustration of newspapers, periodicals of all classes and books, or prints to be sold to calendar and postcard publishers or for sale in art stores, is perhaps the largest and most profitable market open to the amateur or professional who seeks to make money with the camera as "a side line." This is indeed a very big field today, and not so easily handled as was the case a few years ago. But the main factors of success in it are practically unchanged and its rewards are well worth while.

The Results

Practically it amounts to this: The wide-awake amateur or professional who will put a certain amount of intelligent work into this field can make from $100 to $1,000 a year out of his prints. For example, a certain magazine recently paid $100 for four prints of sundials. An amateur, who happened to be on the spot with a Kodak, made over $200 out of a head-on railroad collision. A New York professional netted $125 from the newspaper use of a wedding party, of considerable local prominence, leaving the church after the ceremony. Other workers in this field are getting $2,000 a year out of their spare time with the camera; some of these, with more time and harder work, will probably evolve into specialists and eventually get a net yearly income of $3,000 or $4,000 out of it. It is difficult to forecast the possibilities. I recall an amateur who realized $300 a year for two or three years from a lucky snapshot of eight pet rabbits in a row. So it goes. Who can tell?

Factors of Success

The factors of success in this field can be expressed in a single sentence: Make pictures of public interest, find a publisher and get the best possible price for your work. That sentence tells the whole story. There is a large and increasing demand for certain sorts of photographs for publication—a demand which actually exceeds the supply. And it is comparatively easy to sell photographs other than those of the sort in ready demand, if you can produce the pictures and ferret out a publisher willing to "see" the proposition and pay your price for the prints. For example, the most prominent American fashions magazine recently paid a good price for four photographs of a cathedral now building in New York. You would not dream that such a thing could happen—but it is a fact. I am simply relating a few of the instances which have come under my observation. Of course the big figures are not reached in the first year, unless by a happy chance; but, even as a hobby for the leisure hours or days, making photographs for publication is profitable.

The Field: Information

I have said that this specialty occupies a big field. To attempt to describe the different kinds of photographs which are in demand for illustration purposes in newspapers and magazines, in the commercial world for advertising, or for the other hundred and one uses for photographs, would require a book in itself. To briefly cover the photographic methods used and the general handling of subjects would fill another book. And the adequate treatment of the all-important subject of selling the prints calls for another little handbook. Hence the reader cannot expect to find these things dealt with in detail here. "Photography for the Press" is fully covered in THE PHOTO-MINIATURE Nos. 124 and 51; "Photography in Advertising" in No. 63; and "Marketing Photographs for Publication" in No. 120 of this Series. British readers, in addition to the above, should consult Mortimer's and Everard's little handbooks on the subject. The three numbers of THE PHOTO-MINIATURE mentioned are out of print with the publishers, but may possibly be found on the shelves of some dealers or in many public libraries and are worth looking for as giving the methods and suggestions of successful experts in this field.

A Practical Introduction

For the helping of those who cannot find the books I will very briefly summarize the information necessary for a practical introduction to this field. The first step is to decide upon the particular line of illustration work or corner of the field you think offers you the most chances of success. If you are remote from the big city, newspaper illustration of the better sort may ffer you few opportunities, but you should always ave at least one eye open for any subject near at home r local happening of interest to the big world and so alable to the metropolitan newspapers. And don't orget that saying of Josh Billings to the effect that pportunities are made quite as often as they happen. There are many things, people, incidents and accidents belonging to the small town or village which may nterest the citified millions reached by the big illustrated Sunday supplements of the metropolitan papers.

Newspaper Needs

For those located in a big city the opportunities for making photographs salable to newspapers are practically unlimited. The big city teems with life and activity; there are picture stories around every corner; and the newspaper is hungry, weekdays and Sundays alike, for illustrations showing news interest, unconventional pictures of persons prominent in local, social, political or national life, happenings of present day or historical interest, public or social events, in short any and every thing, incident, or activity in the life of the city which the great public is interested in seeing or knowing about. Photographs of such subjects put into the offices of the newspapers while their interest is still warm are an unfailing source of revenue, and can be provided by the amateur as well as by the specialist press photographer. The newspaper seeks acceptable illustration material, caring little who supplies it, only that it has interest and is offered at the right time if time is of the essence of its interest.

Magazines and Books

For magazine illustration work locality is of lesser importance. Much depends upon the class of periodicals to which the work you make is likely to appeal. You should decide whether you will cater especially to the general or to the special class magazine, and then make yourself familiar with every fact you can discover about the needs and preferences of the editors to whom your prints will go. Book illustration is a very special field, offering comparatively few but generally profitable opportunities. For example, a New England publisher recently issued a remarkably interesting book on

Colonial doorways, gables, and windows. The illustration of the volume pleasantly (and profitably) occupied the leisure days of an amateur during two years. Similarly, the illustration of a series of magazine articles on the oyster industry brought some weeks of pleasant work with satisfactory remuneration to another amateur. The hardest work in this is to get the commission or order for the set of illustrations. Once you find a publisher who has work of the sort in mind, or get a publisher to approve your suggestion for the illustration of a subject, the rest is easy.

News Interest

The biggest difficulty experienced by beginners in the field of illustration is to learn to recognize the sorts of subjects that editors will buy. So far as this can be learned or foreseen there should be no difficulty about it. Study your chosen field. If you mean to work for the newspapers, go carefully over the files in a public library with a notebook, setting down your own brief title for every worth while picture reproduced. When you have, say, five hundred different subjects labeled in this way, classify them and go carefully over the pictures in each class, trying to see just wherein its interest otherwise, salability) lies. Then go out and learn to see life as the newspaper photographer sees it: how he picks his viewpoint and how he treats his subject.

Subjects that Sell

A glance over the periodical files at a news-stand or library will show many openings in special fields. Sports, country life, homes and gardens, home or commercial interiors, agricultural life and incidents, machinery, civic life and urban improvements, road building and engineering construction work, marine and river motor boating, window decoration, old doorways and architectural pictures, churches and public buildings, parkways and public gardens, children at their games, genres and life subjects suited for use in advertising literature, and a thousand other interesting subjects are all worth cultivating in the big field of photography for publication. Travel pictures suggest another special field. And so we might go on indefinitely raking over the possibilities in the way of material.

An Example of Specialization Years ago an amateur, whose business in life was and is the printing of horticultural catalogues and magazines, took up the photographing of flowers, trees, plants and gardens as a hobby which might be helpful in his business. Gradually the hobby developed into a department which now contains many thousands of negatives and prints, carefully indexed, which is drawn upon by seedsmen, nurserymen, forestry experts, magazine and book publishers from coast to coast for illustration purposes at a price per print. The department is, of course, an extremely profitable sideline. Many similar examples might be mentioned, but this one is typical of all.

Technical Quality The photographic or technical side of illustration work demands a word or two: Except where purely pictorial photography is the specialty pursued, photographs intended for publication should be good, clean, straightforward photographs, crisp in definition and clear in detail. You will need to know your camera inside and out, what it can do and what it cannot do. You must be master of your lens and shutter equipment and all the apparatus you use. The so-called mysteries of hyperfocal distances, depth of field, and "stop" values; the advantages of different sorts of cameras, finders and exposure shutters, and all the little tricks and devices which help so much in the unordinary circumstances must be at your finger ends. You must systematize your darkroom and enlarging or printing methods so as to be able to turn out thoroughly good prints in a hurry if needs be.

Sizes: Enlarging The standard size print for illustration purposes is 5 x 7 in. If your camera gives a smaller size than this it will be wise to provide a convenient apparatus and method for enlarging from your negative to this size. Don't let this mention of enlarging bother you. Enlarging today is as simple as printing in a contact frame. One of the foremost commercial specialists of New York uses a 5 x 7 Graflex exclusively for negative making, but the prints he sends out to his clients or to the papers range all the way from 5 x 7 to 20 x 28 in. His enlarging system, well thought out, is a model of its kind, and the finished enlargements, untouched by hand work, are free from blemish and indistinguishable from contact prints of the best sort. You can find working instructions and diagrams for the devising of an enlarging room of the right sort, such as this man uses, in The Photo-Miniature No. 100. For simpler enlarging methods and apparatus see No. 144 of the same Series. The technical details as to apparatus and working methods used by press photographers are set forth in No. 124 of this Series, while the photographing of outdoor sports is treated in No. 161 of the Series. See also The Photo-Miniature, Nos. 151, 159 and 162.

Selling Prints

The selling of photographs to the papers, or for special illustrative purposes, covers finding a market for the sort of subjects you have to offer, settling upon a scale of prices for general use, devising a register for the entry of prints sent out with their subsequent history, investigating the different fields or corners of the market where you can possibly place your prints, how to submit your work to editors and possible buyers of the material you have to offer, copyrighting selected pictures for your protection where this is worth while, selling agencies which may or may not help you in finding purchasers for your work, getting credit for your work on its publication, how to pack and send your prints as so to ensure proper delivery and consideration and the safe return of those not used, etc. These things, as I have said, need a little book devoted to their proper consideration, and cannot be even briefly summarized in the space I have here. You will find the book in The Photo-Miniature No. 120, wherein a successful worker in this specialty has covered every detail from his hard won experience. The book is out of print, but you may find a copy at the dealers' or in your public library.

List of Buyers

A carefully compiled list of the buyers of illustration material is indispensable to those who would cultivate this field. Several such lists have been published during the past few years, but their information quickly goes out of date, and they should be frequently corrected, added to, and revised. The latest and most comprehensive list of this sort is that which is given in the following pages, corrected and revised to the end of June, 1917. This list contains hardly more than half the number of existing buyers of photographs for illustration purposes, but it is the best obtainable at the moment. It will serve well as the base for the ideal list. Copy each item, or the items in any particular field, onto index cards and file the cards in alphabetical order, adding to and revising your list as your secure new information of changes in the market represented by your list. Make every effort to record on each card every bit of useful information you can secure about the buyer represented by the card. Much of this information you will secure in your personal correspondence with the buyers on your cards. Information as to changes and additions to the list of buyers is given in more than one photographic journal and in *The Editor* (Ridgewood, N. J.). There is also a remarkable book, "1001 Places to Sell Manuscripts," published at $1.62 by The Editor Company, which lists and describes almost all the worth while papers using photographs for illustration purposes, which the worker in this field will find immensely useful.

A List of Buyers or Publications Seeking Illustration Material

This list gives the names and addresses of over two hundred papers or publishers known to buy and use photographs for illustration. As a general rule, it may be said that all publications using photographic illustrations are in the market for illustrative material. It is well, however, to first correspond with the editor or publisher, except where haste is essential, stating your special line of work and asking particulars as to his needs, prices, terms of payment, etc. In submitting prints, send all possible data with the prints, and enclose postage stamps sufficient for the return of the prints if not used. No responsibility whatever is accepted by this magazine with reference to any of the buyers mentioned, but the list has been compiled with care for the protection of the reader as far as this is possible. It is advised that all dealings with the firms mentioned in the list of Foreign Buyers should be preceded by correspondence and a definite, written agreement as to the terms of dealing.

Agricultural Epitomist **New York City**	Buys prints of agricultural subjects; vertical compositions preferred. Any size; clear, sharp prints. Quote prices on prints.
Agricultural Epitomist **Spencer, Ind.**	Views that can be used in a farm journal, especially "poultry" and "seed and seedling" pictures.
American Agriculturist **315 Fourth Ave.** **New York City**	Buys prints of live stock, farm homes, and agricultural subjects. Size, 5 x 7; 6 x 8. Price paid, 50 cents to $2 per print.
American Art Works **Coshocton, Ohio**	Photographic studies for calendar and novelty specialties.
American Boy, The **Detroit, Mich.**	Prints of any subjects interesting to boys. Size immaterial. $1 to $3 per print.
American Blacksmith, **Buffalo, N. Y.**	Unmounted prints. Blacksmithing, shops and operations. 3¼ x 4¼ and larger. 10 cents to $1.
American City, The **87 Nassau St.** **New York City**	Photographs of articles advertised in this journal, showing them in practical use.
American Cultivator **62 Sumner St.** **Boston, Mass.**	Mounted or unmounted prints of agricultural subjects. 5 x 7. $1 to $1.50. $3 for copyright photographs when used for cover design.
American Dressmaker **41 West 25th St.** **New York City**	Illustrated fashion articles of especial interest to dressmakers.
American Exporter **New York City**	Harbors, shipping interests, wharves, vessels, packing and shipping methods, systematic business methods.

American Furrier **New York City**	Illustrated fashion articles of interest to the trade.
American Golfer **New York City**	Prints of golfing subjects. Size immaterial. Payment varies.
American Miller **Chicago, Ill.**	Pictures of mills of all sorts, both new and in use. A short story with picture.
American Paint and Oil Dealer **St. Louis, Mo.**	Prints of paint departments in retail stores and paint window trims. Any size, mounted or unmounted. $1.
American Press Association **New York City**	News and feature photographs.
American Printer, The **New York City**	Photographs of unusual interest, preferably such as can be connected with the printing trade.
Anglo-American Post-Card Publishing Co. **413 Broadway** **New York City**	Subject material for postcards.
Apparel Gazette **311 East 4th St.** **Los Angeles, Cal.**	News items and photos of interest to the trade.
Architectural Record **11 East 24th St.** **New York City**	Prints of architectural subjects—exteriors, interiors, bits of detail, etc. Size, 8 x 10. $1.50 to $3.
Art **334 Michigan Ave.** **Chicago, Ill.**	Articles and pictures dealing with pure and applied art.
Automobile Topics **103 Park Ave.** **New York City**	Garage methods and plans of equipment of interest to dealers.
Bain, George Grantham **32 Union Square** **New York City**	News pictures of individual men and women.
Baltimore and Ohio Employers' Magazine **Baltimore, Md.**	Photographs pertaining to railroading, tracks, engineering work, repairs.
Bank Life **Boston, Mass.**	Bank systems, new bank buildings, successful bankers, etc. Payments not large but prompt.
Barse & Hopkins **526 West 26th St.** **New York City**	Prints suitable for calendars, etc.

Bausch & Lomb Optical Co. **Rochester, N. Y.**	Original negatives of subjects suitable for pictorial advertising in catalogues, circulars, etc. Pictures must have been made with Bausch & Lomb lenses.
Bence Co., The E. S. **Carthage, N. Y.**	Manufacturers of calendars, souvenir postcards, etc. At this time photographs of army maneuvers are desired.
Bigelow, Edward F. **Arcadia** **Sound Beach, Conn.**	Outdoor, nature and allied photos. Sometimes expects contributions of photographs to be gratuitous.
Blanchard, Harry F. **65 Hudson St.** **South Glens Falls, N.Y.**	Negatives. Pictures to be used for magazine covers. Farm subjects. 4 x 5, larger size preferred; glossy paper. Pay according to value of photograph.
Boy's World, The **Dew Drops** **Mother's Magazine, The** **David C. Cook Pub. Co.** **Elgin, Ill.**	*The Boy's World* wants pictures of subjects for general interest to boys between 10 and 16 years of age; pictures of children in action. *The Mother's Magazine* wants subjects on child life, home life, picnic parties, summer outings, table decorations, etc.
Breeder's Gazette, The **Chicago, Ill.**	Glossy unmounted prints of farm life. Any size. $1 up.
Brown Bros. Photo Service **New York City**	Subjects of news interest.
Brown & Bigelow **St. Paul, Minn.**	Photographic subjects for art calendars, celluloid novelties, and cloth and leather specialties.
Building Age **239 West 39th St.** **New York City**	Prints. Reference to the publication will show type of photograph desired. Up to 10 x 14. 50 cents to $3.
Bureau of Practical Arts **Grundmann Studios** **Boston, Mass.**	Household arts, activities of women, particularly in the home.
Business **Detroit, Mich.**	Successful men and women, business equipments and office systems. Rates fair.

Campbell Art Co. **Elizabeth, N.J.**	Prints of new and pleasing subjects for art reproductions and pictorial advertising.
Canadian Horticulturist, The **Peterboro, Ont., Can.**	Gardens and orchards; agricultural machinery at work most desired.
Celebrity Art Co. **36 Columbus Ave.** **Boston, Mass.**	Pictures suitable for calendars, motto cards, etc. Submit prints with return postage.
Cement Era, The **1201 Morton Bldg.** **Chicago, Ill.**	Mounted or unmounted prints. Concrete construction. Any size. 50 cents to $2.
Cement World **Chicago, Ill.**	Cement manufacture and concrete construction, from the raw material to the finished product.
Central Press, The **Cleveland, Ohio**	Pictures of persons and scenes which are mentioned in the news.
Century Magazine **(Art Department)** **New York City**	Prints for illustration of articles in hand. Size immaterial. Payment varies.
Christian Science Monitor **Boston, Mass.**	Articles, with photographs, concerning big engineering and public improvement schemes.
Collier's **416 West 13th St.** **New York City**	Prints, unmounted Velox. Current events. 3¼ x 5½, or smaller if clear and sharp. $3 to $5.
Concrete, Cement Age **97 Fort St., West** **Detroit, Mich.**	Two journals. They want pictures of concrete roads and pavements, bridges, ornamental objects, fences, posts, etc. Unmounted prints.
Country Gentleman, The **Philadelphia, Pa.**	Large estates, approved farming methods, home life pictures. $1 to $5. Statement must accompany each photograph.
Country Life in America **Doubleday, Page & Co.** **Garden City, L.I., N.Y.**	Prints must be on glossy paper, not too contrasty. Pertaining to country life. 6½ x 8½. $1 to $10.
Countryside Magazine, The **334 Fourth Ave.** **New York City**	Prints of flowers, vegetables, gardens. Houses (both large and small) that are noteworthy and of suggestive value to prospective builders.

Curt, Teich & Co. 125 West Ohio St. Chicago, Ill.	Subject material for postcards.
Dew Drops.	See *The Boy's World.*
Dodge Publishing Co. 220 East 23d St. New York City	Prints and negatives of landscape and child studies. Size immaterial. $2 up per negative.
Drysdale Co., The 209 South State St. Chicago, Ill.	Publishers of Things Artistic. Photographs and original designs.
Eastman Kodak Company Rochester, N. Y.	Annual advertising competition $3,000 cash prizes for photographs for advertising purposes. See photographic papers for announcements.
Edgell Co., The 13th & Hamilton Sts. Philadelphia, Pa.	Photographs for illustrations, calendars, etc. No landscapes. Prices vary.
Electrical Review and Western Electrician 608 South Dearborn St. Chicago, Ill.	Subjects of definite relation to the electrical industry.
Engineering News New York City	Prints of technical interest. Size 8 x 10 preferred. Payment varies.
Every Week 52 East 19th St. New York City	Unconventional photographs of interesting, not famous, people, accompanied with short sketches of from 200 to 500 words. Also interesting photographs of new inventions, unusual achievements, curious occurrences, etc. Will be paid for according to their value.
Factory Chicago, Ill.	Photographs of successful managers, factory office systems, factory equipment, machines, engines, parts, new patents, etc. $1 to $10.
Farm and Dairy Peterboro, Ont., Can.	Farm and dairy scenes.
Farm and Fireside Springfield, Ohio	Prints of farm subjects; prints telling stories in themselves preferred. 5 x 7 and larger. $1 per print, unless photograph is unusual.

arm and Home **Springfield, Mass.**	Prints of up to date farm buildings, well bred live stock, farm scenes. Glossy contrast paper. 4 x 5, 75 cts.; 5 x 7, $1; 6½ x 8½ and 8 x 10, $1 to $1.50.
Farm and Home Builder **Phoenix, Ariz.**	Farm home life, small model farm homes.
Farm Life **Spencer, Ind.**	Stock prize winners, marketing methods and exhibit, unusual things in farm life.
Farm Journal **Washington Square** **Philadelphia, Pa.**	Farm and household pictures.
Farm Press **Chicago, Ill.**	Prints of agricultural subjects. Any size. 25 cts. to $2.
The Farmer **Webb Publishing Co.** **55 East 10th St.** **St. Paul, Minn.**	Prints: farm scenes, illustrating conditions in Northwest. Any size, 50 cts. to $1. Familiar scenes to northwestern farmers. 8 x 10. $2 and up.
Field and Farm **Denver, Col.**	Farming rocky soil, modern fruit culture, farm homes. 50 cts. to $1.
Folmer & Schwing Division **Eastman Kodak Co.** **Rochester, N. Y.**	Negatives made with Graflex cameras only. Send proofs from negatives. Suitable for publicity work. Proofs returned with letter accepting or declining negative.
Forest and Stream **127 Franklin St.** **New York City**	Shooting, fishing and general outdoor subjects. Any size. Cover size must be multiple of 5 x 7. Payment varies.
Foster, Warren Dunham **120 Boylston St.** **Boston, Mass.**	Prints for magazine and newspaper reproduction; subjects connected with household arts and better country living, or in any way connected with the movement for better living conditions in the small towns and open country, with the activities of women, particularly in the home. Size immaterial.

Fruit Grower and Farmer, The St. Joseph, Mo.	Prints, three classes: horticultural, agricultural and photographs illustrating domestic economy. 4 x 5 or 5 x 7, 25 cts. to $15.
Garden Magazine, The Doubleday, Page & Co. Garden City, L.I., N.Y.	Photographs of horticultural value.
Gardening Monon Building Chicago, Ill.	Photographs of trees and flowers, 5 x 7, unmounted, packed flat.
Gartner & Bender Chicago, Ill.	Prints: story telling, nature, landscapes and marine. 5 x 7 or 8 x 10. $5 to $10.
Gilbert Postcard Co. 141 West Ohio St. Chicago, Ill.	Subject material for postcards.
Green Book Magazine North American Bldg. Chicago, Ill.	Unusual photographs of people and incidents in non-professional sports.
Green's Fruit Grower Rochester, N. Y.	Prints of fruit farming. 4 x 5 to 6½ x 8½. Payment varies.
Grit Publishing Co. Williamsport, Pa.	News photographs. Prints of human figure in central point of interest; one or two figures. 5 x 7 or 6 x 8. 50 cts. and up on copyrighted photographs.
Gutmann & Gutmann 24 East 21st St. New York City	Subject material for postcards.
La Hacienda Buffalo, N. Y.	Prints, unmounted. Agricultural. 3¼ x 4¼ or larger. 25 cts. to $1.
Hannah, Henry King 277 Broadway New York City	Write regarding pictures he wants.
Harper Bros. (Art Dept.) Franklin Square New York City	News photographs.
Herald Syndicate New York City	News photographs.
Herrington Art Co., The 207 Florence Ave. Bloomfield, N. J.	Negatives of landscapes, country scenes, figure studies. Any size. Sample prints on dead matt paper. 50 cts. to $5.

Holland's Magazine **Dallas, Texas**	Prints: southern states, current and historical interest, homes and buildings out of the ordinary. Preferably not smaller than 5 x 7 and unmounted; clear and distinct. Brief statement attached to each print-$1 to $3.
Homestead **Des Moines, Iowa**	Child life, rural home life with a personal or human touch. Rates good.
House and Garden **31 Union Square** **New York City**	Maximum size is 6½ x 9½, glossy prints, unmounted. Scenes showing garden opera. tions, rooms decorated in good taste. Price for copyright photographs determined between editor and contributor.
House Beautiful, The **3 Park St.** **Boston, Mass.**	Prints of attractive small houses and gardens. Any size; cannot use any on a smaller base line than 4 inches. $1 to $5.
Housekeeper, The **443 Fourth Ave.** **New York City**	Pictures pertaining to the household.
Illustrated Current Events **902 Chapel St.** **New Haven, Conn.**	Conducts a photo-news service for window display for which it purchases photos that connect with up-to-the-minute news.
Illustrated Outdoor World and Recreation **17 West 42d St.** **New York City**	Hunting, fishing and sports of all kinds, particularly action pictures.
Illustrated Review **Chicago, Ill.**	Genre and other subjects relating to music, suitable for covers, blotters, calendars, etc. Any size. Price according to use made of print, subject, etc.
Illustrated World **58th St. and Drexel Ave.** **Chicago, Ill.**	Prints: news pictures, oddities, 5 x 7 or 8 x 10, unmounted, glossy, copyrighted. Price paid varies.

Illustration Department **Doubleday, Page & Co.** **11 West 23d St.** **New York City**	Prints, every description. 5 x 7. $1 and upward.
Independent **130 Fulton St.** **New York City**	Seldom buys prints except news photographs. In March, April, and May need subjects available for illustration of special vacation number, for which cash prizes are offered.
Inland Printer, The **Chicago, Ill.**	Needs same as *American Printer*, which see.
Inland Storekeeper **Delhi, N. Y.**	Shop-window displays, interiors, decorated floats of trade houses.
Inland Storekeeper **Chicago, Ill.**	Prints of store fronts, counter displays.
Insurance Engineering **New York City**	Occasional articles with photographs. See the magazine for acceptable subjects.
E. C. Kropp Co. **258 Jefferson St.** **Milwaukee, Wis.**	Subject material for postcards.
Ladies Home Journal **(Art Department)** **Philadelphia, Pa.**	Always willing to consider photographs submitted to the editors for approval, and, if available for use in the *Ladies Home Journal*, will purchase at prices which vary according to the subject, the reputation of the photographer, etc.
Leslie's Illustrated Weekly **225 Fifth Ave.** **New York City**	Prints of news and odd subjects, 4 x 5 and larger, $3 and up per print. Unmounted prints, must be sharp and contrasty. War pictures, news and educational subjects. 5 x 7 up. $3 up.
Life Publishing Co. **New York City**	Subjects likely to be of special interest to readers of *Life*. Size immaterial. Payment varies.
Literary Digest, The **(Art Department)** **354 Fourth Ave.** **New York City**	Prints of news value. Any size, unmounted. $3.

Little Wanderer, The 64 West Randolph St. Chicago, Ill.	A magazine for boys and girls. Photographs occasionally.
Majestic Publishing Co. 316 Newton-Claypool Building Indianapolis, Ind.	Original designs and texts for postcards.
Metropolitan Magazine 286 Fifth Ave. New York City	Except dramatic subjects, uses only photographs made to order. Size immaterial. Average price, $3 per print.
Midland Publishing Co. Grand St. & Morgan Ave. Brooklyn, N. Y.	Photographs of comic and art subjects for postcard and booklet use.
Millinery Trade Review New York City	Illustrated fashion articles of interest to the trade.
Missouri Valley Farmer Topeka, Kans.	Live stock and agricultural scenes in the Middle West. Postcard size preferred. 25 cts. to $1.
Modern Priscilla Boston, Mass.	Buys prints only reproducing original patterns in different kinds of fancy needlework, and photographs illustrating household articles. Size immaterial Payment varies.
Monthly Magazine Section Fifth Avenue Bldg. New York City	Photographs of prominent people.
Mother's Magazine	See *The Boy's World*.
Motor 381 Fourth Ave. New York City	News items, automobile industry.
Motor 119 West 40th St. New York City	Prints mounted or unmounted, of unusual interest from motoring point of view. Any size. $2 to $3.
Motor Boat 1133 Broadway New York City	Motor-boats in action, scenes in which motor-boats are prominent features. 4 x 5 to 8 x 10. $1 per print.
Motor Cycle Illustrated 51 Chambers St. New York City	Motor-cycle subjects. Any size. Payment varies.

Motoring Indianapolis, Ind.	Incidents of motor trips; interest to dealers, such as garage methods and equipments.
Motorist Bee Building Omaha, Neb.	Novel photographs of interest to motorists.
Musician, The Oliver Ditson Co., Publisher Boston, Mass.	Character in musical work; pictures that tell a story.
Myers Company, Elwood Springfield, Ohio	Photographs of subjects suitable for art calendars, also for advertising calendars. Photographs of children and animals.
National Calendar Co. Suite 933, 80 Maiden Lane New York City	Purchase photographs of distinctive New York City scenes for calendars. Must be artistic and different from ordinary run of postcard pictures.
National Colortype Co. Cincinnati, Ohio	Subject material for postcards.
National Farmer and Stock Grower St. Louis, Mo.	Individual animals, live stock groups, etc. 5 x 7, unmounted. $1 per print.
National Geographic Magazine Washington, D. C.	Plain prints and hand-colored prints of scenes in various parts of world, types of people, etc.
National Magazine Boston, Mass.	Articles with illustrations, manuscripts and pictures describing towns and states; farming regions, etc.
National Sportsman Magazine Boston, Mass.	Outing photographs. 3¼ x 4¼. 50 cents per print.
Nautilus and Health Magazine, The Holyoke, Mass.	Photographs occasionally to illustrate articles of social or economic interest; designs for use at head of articles sometimes purchased from artists.
Nebraska Farm Journal Omaha, Neb.	Farm scenes and live stock in Nebraska. 4 x 5 or larger. 25 cents and up per print.
Newspaper Enterprise Association Chicago, Ill.	Photographs suitable for magazine and pictorial supplements of newspapers.

Noble & Williams Novelty Co. Box 173 Morsemere, N. J.	Pictures for blotters, advertisements and calendars.
Oakley, P. Benson Box 102 Norwich, N. Y.	Photographs of unusual events, aviation, fires, great disasters, floods, etc.
Orange Judd Farmer Chicago, Ill.	Farm scenes, live stock, crop exhibits, home departments. 50 cts. to $2.
Outdoor Life New York City	Usually buys illustrations with its manuscripts.
Outdoor World and Recreation 2 Duane St. New York City	Odd and unusual outdoor material.
Outer's Book Chicago, Ill.	Prints of interest to the hunter, camper and fisherman. 3¼ x 4¼ or larger.
Outing 141 West 36th St. New York City	Glossy prints: outdoor recreation. 4¾ x 7½ upright. Write for detailed information.
Outlook New York City	Buys news, scientific photographs, etc., and portraits. 5 x 7. Price varies.
Ozark Farm and Fruit Belt Siloam Springs, Ark.	Fruit culture, insects, pests, spraying methods, orchards, marketing fruits. 50 cts. and up.
Pacific Motor Balboa Building San Francisco, Cal.	Autos on good and bad roads. Motor parties.
Perry, Wm. H. Lynn, Mass.	Photographs for calendars.
Photo News Service 136 West 52d St. New York City	Photographs covering important news events if sent quickly after event, with descriptive matter. $1 to $5 for good prints.
Poole Bros. Railway Printers 87 Harrison St. Chicago, Ill.	Prints of recreative, travel or scientific character, with descriptive data.
Popular Mechanics 7 East 44th St. New York City	Contractors write regarding work.

Popular Mechanics Magazine 318 West Washington St. Chicago, Ill.	Photographs of new, curious and interesting things; almost everything except portraits. Any size; clear, sharp prints, preferably glossy. Description on the back of the print.
Popular Science Monthly 239 Fourth Ave. New York City	Interesting inventions at work; curious applications of old machinery; queer ways of getting a living.
Power Wagon Chicago, Ill.	Motor trips, new and unusual uses of automobiles and trucks.
Press Illustrating Co. 106 Fulton St. New York City	News photographs.
Profitable Storekeeping 525 Monroe St. Chicago, Ill.	Prints of stores, store fronts, anything of interest or value to the retail merchant. Any size from postcard up; glossy.
Progressive Farmer Birmingham, Ala.	Children on farms at work and play, cattle, and the adoption of machinery to modern farming. Prints, 25 cts. to $1.
Record Herald Chicago, Ill.	Newspaper subjects.
Recreation 2 West 33d St. New York City	Prints hunting, fishing, etc. 5x7, glossy Velox, unmounted. $1; copyrighted $1 and up.
Retail Equipment Scranton, Pa.	Store fronts, counter displays, etc.
Rochester Photo Press Rochester, N. Y.	Negatives: art heads and story-telling pictures. $1 up.
Root's Motor Digest 213 East 21st St. Chicago, Ill.	Auto scenes, scenes on good roads. Consult the editor first.
Round Robin Reader Boston, Mass.	Subjects of interest to children; prints suitable for front cover designs.
Rural New Yorker 409 Pearl St. New York City	Subjects of unique agricultural interest.
St. Nicholas Magazine New York City	Juvenile subjects and illustrations of special descriptive scientific or nature articles. 8 x 10. Price paid varies.

St. Nicholas Magazine (Nature and Science Department) **Arcadia, Sound Beach, Conn.**	Novelty or beauty in realms of nature or science, inventions, etc.
Saturday Blade **Chicago, Ill.**	Curious or interesting scenes which would be of interest to its readers; description or explanation of each picture.
Saturday Evening Mail **New York City**	Photographs of news subjects, well-known persons or scenes of special interest. Mark prints "not sent for competition but for acceptance on usual terms."
Scribner's Magazine **New York City**	Prints of historical and geographical interest, portraits, sculptures and paintings. 8 x 10. 20 cents to $2.50
Shaw Advertising Co., The **110 West 3d St.** **Kansas City, Mo.**	Photographs for calendar illustration and advertising novelties.
Shoeman (Manufacturers' Section) **95 South St.** **Boston, Mass.**	Prints of interiors or exteriors of shoe factories, wearers of queer or unusual foot-coverings. $1 to $3.
Snelling, Walter O. Ph.D. **40th & Butler Sts.** **Pittsburgh, Pa.**	Prints of explosives in blasting, farming, quarrying, etc., accidents from explosives, glass explosions, etc. Any size. $1 to $3.
Sprague Publishing Co. **Detroit, Mich.**	Photographs of boy interest, or outdoor life, for boys of 9 to 18 years of age.
Star Farmer, The **716 Lucas Ave.** **St. Louis, Mo.**	Farm, stock and home subjects. Any size. Price paid varies.
Strand Magazine **85 Duane St.** **New York City**	"Curiosities," with brief description.
Strout, E. A. **47 West 34th St.** **New York City**	Farm scenes, harvesting, children at play, boating, fishing and outdoor subjects, for advertising purposes. Send description of what you have to offer.

Stuart, N. H. Kalamazoo Loose Leaf Binder Co. Kalamazoo, Mich.	Print of prize bull-dog. 8 x 10, mounted or unmounted. Reasonable price.
Successful Farming Des Moines, Iowa	Farm and home life.
Sunday Globe Boston, Mass.	Articles and photographs of subjects relating to New England.
Sunday Tribune Chicago, Ill.	Interesting news pictures of all kinds.
Sunset Magazine San Francisco, Cal.	Prints of Pacific Coast scenery and life. 6½ x 8½, unmounted. 50 cts. to $1. $3 for copyright photographs. Will return prints if 50 cts. is sent.
System Wabash & Madison Aves. Chicago, Ill.	Fiction scenes, business pictures.
Thompson Art Co. Portland, Maine.	Prints and negatives of good quality. Nature without figures. 4 x 5 and 5 x 7. Unmounted. $1 to $5.
Tichnor Bros., Inc. 251 Causeway St. Boston, Mass.	Subject material for postcards.
Town Development New York City	Landscape gardening, public improvement methods, plans and civic leaders. Good prices paid.
Tradesman Bee Building Omaha, Neb.	Photographs of interior arrangement of stores, show windows, any methods of displaying goods, or any photographs of interest to retail merchants.
Travel 31 Union Square North New York City	Prints, any size. Originality and human interest first, then composition and effect. 75 cts. to $2, depending on size and quality. Prints returned on request, but deducted from price.
Trucker and Farmer New Orleans, La.	Offers first prize $5, second $3, third $1.50, for pictures of agricultural scenes of the South. Offered every month.

Underwood & Underwood **417 Fifth Ave.** **New York**	People or events of interest. Every sort of subject.
University Society, Inc. **44 East 23d St.** **New York City**	Pictures of children all ages up to 12 or 14.
Voigtlander & Sohn **Chicago, Ill.**	Prints unmounted. Home portraits and speed pictures, made with Voigtlander lens. Can use 3¼ x 4¼, prefer 5 x 7. Price depends on value of picture for advertising.
Western Empire **Los Angeles, Cal.**	Prints of western farm life; stock. 50 cts. to $2.
Women's Home Companion **381 Fourth Ave.** **New York City**	Has frequent competitions with liberal cash prizes. Write magazine for particulars of subjects desired, etc.
Woodward & Tiernan Printing Co. **St. Louis, Mo.**	Photographs for advertising purposes, calendars and souvenirs.
World's Work **Garden City, L. I., N. Y.**	Photos illustrating current progress in all field of endeavor. Also of distinguished people of timely news interest.
Worth While **Washington, D. C.**	A weekly magazine that publishes photographs of successful people and the result of their success. Payment not large.
Yachting **141 West 36th St.** **New York City**	Unmounted prints, not to be returned. Yachts, motor boats and marine. 4 x 5, $1; 5 x 7 and 6½ x 8½, $1.50; 8 x 10, $2.
Youth's Companion **(The Art Editor)** **Boston, Mass.**	Occasional prints suitable for its "Nature and Science" Department.

All the big New York, Philadelphia, Boston, Chicago and San Francisco Sunday papers are buyers of pictures. Correspond with the Art Department first in all cases.

FOREIGN BUYERS

This list comprises chiefly press illustrating agencies whose business it is to dispose of illustration material sent to them "on sale or return" by photographers in all parts of the world. See the suggestion as to preliminary correspondence at the head of this list.

Alfieri Picture Service 4/7 Red Lion Ct., Fleet St. London, E. C., England.	General.
Barratt's Photo Press, Ltd. 8 Salisbury Ct. London, E. C., England.	General and labor.
Central News (Illustrations Department) 5 New Bridge St. London, E. C., England.	Home, colonial and foreign news-photos and portraits. Agents for photographers all over the world.
Graphic Photo Union Tallis House, Tallis St. London, E. C., England.	Topical events everywhere.
Illustrations Bureau Bouverie St. London, E. C., England.	British and foreign news.
London News Agency Photos Ltd. 46 Fleet St. London, E. C., England.	The world's happenings in photographs.
News Illustrations 4 Johnson's Court London, E. C., England.	British and foreign news.
Newspaper Illustrations Ltd. Strand London, W. C., England.	
Pictorial Press 26 Poppin's Ct. London, E. C., England.	General and sports.

ress Photographic Agency 170 Fleet St. London, E. C., England.	British and foreign news.
ischgitz, A. 42 Linden Gardens London, W., England	Illustrations, literary, artistic and antiquarian.
port and General Press Agency Ltd. 45 Essex St. Strand, London, England.	British and foreign news, sport, industrial, agricultural. Agents in all parts of the world.
opical Press Agency 10/11 Red Lion Ct. Fleet St. London, E. C., England.	Supply anything from anywhere.
Universal Photo Exchange, Ltd. 1 Mitre Court London, E. C., England.	Agents for the supply of professional and amateur photographers' work to the illustrated press.
Underwood & Underwood 104 High Holborn London, W. C., England.	American and continental.

Copying Old Portraits

In every home, rich or poor, there are photographs—Daguerreotypes, Ambrotypes or glass pictures, tintypes and old, faded prints—which are treasured by someone as the most precious things belonging to the life that centers there. Usually they are the sole remaining, irreplaceable mementos of loved ones or members of the family, living or dead, who have gone away beyond recall.

As every professional photographer knows, these old or faded portraits can be copied with scrupulous fidelity without damage to or attempted restoration of the original and, by means of various modern methods, may be reproduced in exact facsimile, or pleasingly varied in shape or form to conform to the fashion of today, or enlarged and finished in chalks, sepia or colors, so as to be even more attractive to the eye than were the originals in all their pristine freshness.

A Profitable Specialty This work of copying old portraits is well within the capacity of many amateurs and offers a very profitable specialty for the home worker who can give to its cultivation the time and skill it demands for its proper development as a source of revenue. I have often wondered why so few have attempted to develop so obvious and so remunerative a field. It is true that almost all professionals announce their readiness to make copies of old photographs, but the majority give little or no attention to the proper cultivation of this class of work and, perhaps as a consequence, the average professional "copy" is a dull, lifeless thing, hardly worth the too low price usually asked for it. To make the right sort of a copy demands much specialized skill and patience, and it is a profitable specialty just because this sort of work brings a good price.

How to go About It There is a right and a wrong way to go about this specializing in the copying of old, valuable family portraits, and it is very important to give the field the consideration it deserves before beginning actual work. You are going to qualify as an expert in a difficult branch of photography and you must first take a proper view of your value as an expert. Be sure that you have the skill and patience and the apparatus necessary to ensure really good copies, even of the occasional difficult original. Don't experiment with your customers' precious originals. Being sure of yourself, next systematize your work and lay out a working method on some such scheme as follows: (1) A plan for securing orders (*a*) among friends, (*b*) by circular letters or cards properly distributed, (*c*) by local or specialized advertising. (2) A method of indexing or registering the valuable originals you receive for copying, so as to avoid all possibility of confusion or loss. (3) A definite system of working or handling your orders. (4) A plan for placing your finished work before the customer and securing payment. Think these details out carefully and so avoid after confusion and loss.

Plan Your Work First

The general methods of securing orders, the character of the work itself, styles of finishing, and the charging of rices and securing payment for work when done, will ecessarily vary widely according to locality and the lass of persons from whom your business is to be btained. You may decide to seek a big volume of rders at a comparatively low price, based on a closely vorked out system and one uniform style of finishing, n a cash with order basis. Or you may prefer to ffer your work in various sizes and styles of finish at lifferent prices and send it out to your customers on he basis of payment on approval. The simpler the nethod the better. The thing is to get the originals n hand to be copied; if after that you give your cusomer back his or her treasured original in perfect rder as received, together with a really good copy, you will find little difficulty in getting paid for it at a air price. There is more personal feeling or sentinent attached to this class of work than to everyday studio portraiture, and this helps in a business way.

A Good Mail Order System

A thoroughly good system for working this specialty as a mail order proposition is given with complete detail in the February, 1917, issue of *American Photography*. It occupies eight pages and covers every point of the system as successfully worked by the writer of the article. It is, of course, too lengthy for republication here, but the magazine can be procured without difficulty. Briefly, the writer of the article describes his field, gives the letter used in securing orders, and tells of his first tests of his publicity system, handling the orders, doing the actual work of copying, itemizes his costs and charges for the work, and winds up with extracts from his customers' letters. The system is one which may well be adapted to workers in different localities.

How a Professional Worked

Another system is that devised and followed with surprising success by a prominent New York professional. He had the advantages of reputation and the best sort of a clientele to draw upon. But the simplicity of his scheme and the great satisfaction it begets in the customer would ensure its success in almost any imaginable circumstances. Briefly outlined it is as follows: A display case on the street calls attention to a few selected examples of copies of different classes of old portraits. A small advertisement is also inserted steadily in a well-known art magazine. The prospective customer is invited to send the portrait to be copied, every assurance being given that it will be well taken care of and returned uninjured and in its original condition within a few days, together with a perfect copy. The copy is invariably printed in platinum—black or sepia—and is one of two sizes, roughly corresponding to 5 x 7 and 8 x 10 inches, although each individual picture is trimmed as to size and shape according to the photographer's personal notion of the requirements of the subject. The print is tastefully mounted and inclosed in a neat folder. The original and copy, so finished, are sent to the customer, accompanied by a letter submitting the copy to the customer's approval. If approved, the price ($5 or $10 according to size) is to be sent to the photographer at the customer's convenience. If the copy is not entirely satisfactory the customer is asked to return it, but with the suggestion that there be no haste in this, so that the customer may take any reasonable time to decide the matter. All the way through the customer thoroughly understands that there is no obligation or liability on his part, except to either pay for the copy if satisfactory at the price charged for it or to return the print. The simplicity of this way of handling the business and the customer, the fact that most if not all of the copies are obviously better and more desirable than the original prints, and the tasteful appearance of the modern copy, are all factors in the success which has attended the scheme in this photographer's hands. Needless to add that the work is unexceptionable in quality and that the percentage of work returned is remarkably small in proportion to that accepted and paid for. Duplicate prints are, of course, offered at a price slightly lower than that charged for first prints when these are desired, but no effort is made to sell copies in quantities. The specialty, worked as here outlined, has netted the photographer thousands of dollars since its introduction.

Technical Help

The methods and working instructions for the copying of all classes of originals have been published in the photographic journals, a very complete summary being given in The Photo-Miniature No. 156, another useful handbook where colored or stained originals are concerned is Mees' "The Photography of Colored Objects." In these three books may be found all the practical information needed for the work. No. 41 in the same Series will also be found very useful. It is out of print with the publishers, but odd copies may still be picked up among dealers or seen at many of the larger public libraries.

A Wartime Specialty

British photographers, instead of experiencing depression in business by reason of the Great War, are finding themselves hard pressed to handle the largely increased volume of business resulting directly from the nation's war activities. It was so here during the Civil War, and we will doubtless see history repeat itself as our own vast preparations for our share in the present war are more fully developed. There will be many profitable opportunities for the man or woman with a camera and a ready knowledge of portraiture, for, needless to point out, the picture of the "boy" or the husband in khaki will be more keenly treasured (because a more intimate portrait) if taken at home, with the familiar surroundings of the home life.

Briefly Described

A wartime portrait novelty with money making possibilities in it is suggested by an enterprising advertiser in an English exchange under the caption "Statue Portraits." The illustration shows a full figure portrait of a soldier in khaki, standing in a dignified but easy pose upon what looks like a small square pedestal, about 3 inches high. The figure stands out in bold relief against a white ground, the portrait, enlarged to about 12 inches in height, being in fact mounted on three-ply wood and cut out by means of a fret saw, so as to stand upon its base on a mantel or table. The picture is hand colored and varnished, thus giving a fairly lifelike presentment of the subject.

The Method of Production

It is obvious that the production of this specialty offers little practical difficulty if a method be devised reducing the manipulation to the fewest possible operations. A focusing hand camera, fixed focus or other handy enlarger and a plain white ground are the essentials. Provide a convenient place for the making of the small negative, measuring off the distance necessary to give a sharply defined full figure portrait with the camera in use and mark this, so that the camera and subject may be placed without delay or trouble. The sheet or other white ground may be permanently fixed in its place ready for use. The enlarger and a supply of bromide or gaslight enlarging paper should be provided beforehand.

In Detail

To make the portrait, place the subject in position, secure a pleasing pose or arrangement of the figure, focus carefully to secure a sharply outlined figure and expose. The negative so obtained is next placed in the enlarger with a piece of bromide or gaslight paper and the enlargement made. This is thoroughly well mounted with a strong, sure adhesive on a sheet of three ply board. When dry, the figure is now cut carefully by outline with a fret saw—a proceeding with which the average boy is very familiar. Be sure to include the base upon which the feet of the figure rest. The portrait, in which the figure may be about 12 inches high, is now colored with any of the water colors or special colors now on the market, and later varnished with a hard, colorless shellac or water varnish, when it is ready for delivery. The price of the British article mentioned is advertised as $1.25 to the trade. It should find a ready sale here at twice that figure and leave a fair profit. The percentage of profit will, of course, depend on how closely the worker can systematize his method of production to save time and eliminate unnecessary operations, so that several portraits may be handled at one and the same time. For example, a local enlarging house will possibly supply the enlargements from your small negatives at, say, 15 cents apiece, thus saving you the bother and expense of the enlarging equipment and process. So, too, a dozen of the enlarged figures could be fret-sawed more cheaply by some one familiar with this method than by attempting to cut each one singly yourself. As far as the portrait making is concerned, if the reader feels the need of instruction in the posing and lighting of the figure, this information can be found set out in detail in THE PHOTO-MINIATURE Nos. 136 and 137. "Home Portraiture" is dealt with in No. 141 and "Enlarging on Gaslight and Bromide Papers" in Nos. 123 and 144 of the same Series.

Working the Scheme

This specialty is one which can be profitably worked in a fairly large way by a live man or woman in a small town adjacent to a big city, by making a connection with a professional photographer who will supply the orders and the original negatives from which the enlarged portraits, colored and finished as outlined above, could be made and delivered back to the photographer at a price. The amateur or professional located near a training camp could, of course, work the specialty more profitably by securing his orders direct and carrying the work through "on his own."

The scheme offers many possibilities of modification. It involves the securing of a full figure portrait of a man leaving home and family to "do his bit" in the Great War. Such a portrait will become valuable later, whether the man himself returns or not. So that a letter sent to the man's folk at the right time, offering prints or some sort of enlargement in this or that form, at a price will be fairly certain to bring business. A collection of such small negatives with an address list of the subjects would be a very desirable source of revenue if discriminatingly handled.

Prints on Fabrics

Photographs on fabrics such as silk, sateen, linen, or muslin offer a specialty which can often be turned to profit by anyone familiar with the methods employed in their production. It is a specialty peculiarly adapted for the woman worker who has free time at home. Such prints are used for the decoration of fancy pillow tops, table center pieces, panels for window screens and similar articles sold at women's exchanges, bazaars, fairs and specialty shops. The prints so sold are generally made on silk. Prints on the coarser fabrics, usually large portraits, are used for the decoration of badges or banners for political, religious or fraternal associations. Narrow strips of muslin, so decorated have been used as a frieze in nurseries or children's playrooms.

Getting Down to Business

The first steps in taking up this work as a specialty are: (1) Familiarize yourself with the methods of producing prints on different fabrics, by contact and enlargement, until you have evolved a simple and practical process giving good results with the least expenditure of time and expense, and (2) make several sets of samples of what you can do, calculating costs and the prices to be asked for the work. This done you can look around and find a market, local or general, for the product. The local studios, art or specialty shops will usually be willing to show your samples and get orders for certain classes of prints on a commissions basis. The officers of fraternal or other associations should be approached as to badges and banners. Firms specializing in interior decoration will consider any designs you may offer as likely to be of use in their work in homes.

Technical Methods

The methods of producing such prints, whether by contact in a printing frame or by enlargement, are comparatively simple and can easily be mastered with a little patient practice. The principal difficulty is to get hold of reliable methods and formulas, many of those published being uncertain in result and calling for considerable personal experimenting. Fortunately I was able, a few months ago, to persuade a practical worker in this specialty to give me his own working methods and formulas. These are published in THE PHOTO-MINIATURE No. 142 and may be relied upon to give results if intelligently followed. The methods cover enlarging upon different fabrics as well as making small contact prints.

Profit from Flowers and Gardens

There is a specially profitable field open to those who will put the necessary skill into the photographing of flowers, trees, vegetables, and gardens. These subjects are very largely in demand today for the illustration of outdoor magazines and books, catalogues, booklets, and advertisements exploiting farming, country, and suburban life, gardening and horticulture generally, summer resorts and holiday places where nature is the feature of chief interest, textbooks on nature study, school use and many similar purposes. The increasing use of decorative natural forms by illustrators and designers, as well as the use of photographic prints for all sorts of decorative illustration, also tend to widen the possibilities. You can never tell where a photograph of flowers will find acceptable use. Only the other day I saw a specialist making a genre of a few choice roses in a glass vase, with a box of cigarettes and a bottle of wine and tumbler combined to serve as an attractive back cover advertisement for a popular magazine. The specialist got $25 for the print from an advertising agency which supplied the accessories needed for the make-up of the design. On an earlier page I have already mentioned how another clever worker turned his skill in this specialty into a perennial source of revenue in connection with his business as a printer. The work is as interesting as it is delightful in the doing, and the methods are fully detailed and illustrated in McFarland's "Photographing Flowers and Trees," etc.

Money in Legal Photography

The growing use of photography in all sorts of legal proceedings points to this field as one in which not a few amateurs in the larger cities might find profitable scope for their free time. Apart from the necessary skill with the camera, the cultivation of this field calls chiefly for an acquaintance with lawyers, insurance and real estate men, which is not a very difficult thing to acquire. The use of the camera in litigation covers chiefly the securing of evidence of all sorts: in civil suits (1) photographing special buildings or parts of buildings, such as stairways alleged to be defective, etc., or rooms showing injuries caused by nearby blasting, excavation, etc., or roots and leaders which by their defective condition have caused injury to the contents of warehouses in a building, etc., (2) the location of an accident in a street, on or under bridges or elevated structures such as the street railroads in New York, in railway depots and public places, (3) premises damaged by fire, explosion or other cause, cars, drays, automobiles, etc., damaged in street accidents, (4) scaffoldings, machinery and similar objects involved in cases of personal injury, (5) views, including portraits, showing persons and places involved in matrimonial suits, and (6) views of property, with or without buildings, used for many different purposes by insurance and real estate concerns. In criminal law the camera is used for the duplication of documents, the detection of forgery, interpolations in documents, photographing persons and places involved in homicide and burglary cases, in preparing court exhibits of all sorts, as showing violation of tenement, health, and food laws, and so on indefinitely. It is obvious that anyone skilled in the use of the camera and possessing some free time can quickly form a business connection in the field indicated, which will provide him with all the commissions he can handle without undue interference with his everyday affairs. In fact, in two instances where amateurs of my acquaintance took up work along the lines here mentioned as a profitable hobby for their spare time, the commissions came so numerously that they had to abandon the venture as obliging them to neglect their respective businesses. Finally, this legal photography brings a larger reward than some other photographic specialty. The work must be unexceptionable in technical quality, and especially the pictures must support the point involved in their use, for which reason those who need it do not hesitate on the score of price. It is a field with many opportunities and is worth cultivation.

Better than $15 a day

The relation of the above matter reminds me of the instance where a clever amateur, who was a well paid insurance adjuster by profession, showed himself so skilled in landscape and view photography that a friendly railroad official insisted upon his taking a two months' holiday, with a special car and all photographic materials found, to photograph the scenery and equipment of the railroad, at a price. The price being acceptable, the amateur took the holiday and delivered the work. Thereafter more work of the same sort came to him so quickly that he could not resume his oldtime profession as an insurance adjuster. When last I heard from him he was summering at a New England fishing village in the endeavor to recuperate after a bad attack of nervous prostration, following the attempt to cope with too much business. So strangely does the pursuit of photography as a sideline end in some cases! In the case here mentioned it had to upset a proposition which brought the amateur $15 a day the year round before he was persuaded to enter upon the new adventure.

Advertising Illustration

There is a splendid field for money making with the camera in the illustration of advertising matter of all kinds. For this field the amateur is just as well equipped as the professional and has a few advantages which the professional has not. As a field for profitable camera work photography in advertising is distinct from photography for the press and deserves separate consideration.

The Field

It is a very big field and offers practically unlimited scope. Briefly summarized it covers the preparation of photographs suitable for the illustration of newspaper and magazine advertisements; for use in commercial catalogues and booklets; for special advertising matter, such as the illustration of resort and outdoor booklets, pamphlets illustrating towns and their attractions, civic and social movements of all sorts, posters, pictorial calendars and the like. As a general thing this field calls for photographs having some pictorial quality or special interest or attraction, pictures that tell a story or definitely illustrate an idea, rather than mere records of places or everyday subjects. Always it demands the technically good photograph, telling its story or illustrating an idea in a straightforward way.

Value of Simple Ideas

The way of success in this field is so simple that many fail to reach success simply because they do not recognize this simplicity and persist in making it involved and difficult. For example: take the attractive illustration of an idea of definite value in advertising a commercial product, and therefore readily salable to the manufacturer of the product or his advertising agency. In almost every household at this season of the year someone is busy "putting up" jellies, jams and preserves of all kinds. Such products must be sealed for their proper preservation until the time of use. The Standard Oil Company markets a refined paraffin unsurpassed for this purpose and very simple in use, the melted paraffin being simply poured over the top of the jelly or other product to be sealed from the air. One day an amateur with imagination made a photograph of a pretty girl engaged in sealing jellies with paraffin and submitted the print, in suitable form, to the heads of the concern charged with the advertising of the product. The picture was immediately accepted and the amateur was well paid for the idea and his presentation of it. More work of the same sort was offered to him as a consequence of his wide-awake-ness. Of course his idea had little originality, most foods and articles in everyday use being attractively illustrated in their advertising. But the field is still full of opportunities and new openings are being offered all the time.

Some Possibilities

Think of the many foods, toilet articles, wearing apparel, tools and conveniences used in trades and sports indoors and outdoors, and you will see the wide range of this field. Look through the advertisements of the magazines and newspapers, catalogues and trade and holiday literature scattered on every hand for abundant suggestions and ideas which have brought money to their originators. Remind yourself of the annual competitions of The Eastman Kodak Company, offering $3,000 in cash for photographs suitable as illustrations in Kodak advertising; the recent $5,000 competition of the Ansco Company for the same purpose; and the standing invitations of such firms as the Bausch &

Lomb Optical Company, the Goerz American Optical Company and others, offering to buy illustration material suitable for the advertising of their products. This is in the photographic field alone, in which, strangely enough, photography plays but a small part in the illustration of advertising matter. The pictorial demonstration of manipulative photography at home and out-of-doors offers an attractive field for illustration, and some day our manufacturers are going to awaken to this fact and change the character of their advertising. The enterprising amateur can force this desirable change, very much to his own advantage, by showing the photographic manufacturer how this or that picture would help to increase his sales by demonstrating the use or the advantage of his specialties.

A Book Worth $100

It is impossible to cover either the possibilities or the methods to be employed in working the field of photography in advertising in any space less than, say, fifty pages, hence I cannot give these particulars here. They were fully dealt with by an expert and successful worker in THE PHOTO-MINIATURE No. 63. This is an out-of-print number but may be found at some dealers or at libraries and is worth the tedious search it may cost apart from its cash value. It should be worth $100 to the man who can apply its information. Briefly the book explains the field, gives instances of its successful working, tells of the mission of the illustration in advertising, the vital points, advertising departments and agencies as markets, and the practical methods used in the production of advertising illustrations, with examples of how the pictures are made and adapted for their use. The handling of models for special purposes and the law covering the field are also discussed as far as is necessary for the protection of the worker.

Selling Prints

The selling of illustration material presents only the problem of submitting the prints to the advertiser direct or to the agency having charge of the manufacturer's publicity. Some firms have advertising departments of their own, others depend wholly upon an agency which provides a specialist for their product, preparing the "copy," illustrating it, placing the advertisements and checking them on a regular charge covering the whole service. The names of the agencies handling any manufacturer's product can be learned from the manufacturer or from an advertising journal, such as *Printer's Ink*. A card list of advertisers or agencies likely to buy illustration material, with brief details of the specialties they advertise, should be prepared and kept up to date by addition and revision from time to time. The prints submitted for sale will, of course, be in some cases merely suggestive; in other cases they may be fully worked out ready for actual use.

Prices

It is not possible to give more than a rough suggestion here as to prices to be asked for material likely to be useful to an advertiser, its value depending upon so many factors. Sometimes a print merely suggesting an attractive illustration of a product may be worth from $5 to $25. A carefully finished bit of work, which completely and attractively illustrates the use of a commercial article and is practically ready for use, may be worth from $10 to $50. On the other hand, a print of the latter sort, submitted in a competition such as the Eastman Competition mentioned may bring $100 to $750. Prints considered to have indisputable value to an advertiser should always be copyrighted by the photographer before being submitted to possible purchasers. The offer to a purchaser may then be for a print for a special proposed use only or for the negative and the copyright. One photographer who sells prints for advertising purposes asks $3 for a print with a signed agreement covering its specific use by the advertiser. If the negative and copyright are desired, the charge varies from $25 to $50 according to the subject and its possibilities in the market. Sets of prints, in series of three to twelve, covering a particular specialty (for example, a pretty model illustrating a series of corset advertisements) may be worth from $50 to $150, all depending on their illustrative value to the advertiser. The way of money making here is to set your wits or imagination to work, produce the right sort of pictures and then, quietly and persistently, seek your buyer.

It is a remarkable market for those who will cultivate intelligently, and the work itself is as pleasantly interesting as it is profitable.

Watch Dial Pictures

There are many little sidelines or specialties worked by the professional studios which offer profitable opportunities to those amateurs who will take the time necessary to acquire the small amount of technical skill required in the work. These specialties may be worked in connection with a local studio not equipped for or not caring to undertake the work, but willing to take orders for it; or they may be worked independently among the reader's acquaintance or as a mail order proposition, using a selected list, locally or generally.

One such specialty is the making of photographs on watch dials, or inside watch caps, or on spoons or "lucky coins." The price for such photographs ranges from $2.50 to $5. The method of making them involves an acquaintance with the carbon printing process and with copying. Fully detailed instructions and formulas for the working method used can be found in THE PHOTO-MINIATURE No. 142 which, incidentally, contains other processes likely to be very helpful to the man who seeks to make money with the camera.

Imitation Enamels

One of these other processes which will well repay cultivation, involving again only a knowledge of copying methods and the carbon printing process, is the making of imitation enamels on china ware or metals. See THE PHOTO-MINIATURE No. 142, pages 462–482. By this process a very durable and beautiful imitation of a portrait in enamel can be produced on any sort of china or porcelain plate or plaque of silvered or gilt copper for wall decoration, or for sale in souvenir and specialty shops. Given the equipment and ability for the production of such a specialty, which simply means working out the method of procedure and getting together the necessary apparatus and conveniences, a profitable volume of business will not be difficult to secure by showing specimens and soliciting orders from local studios, art and specialty shops, or by advertising in magazines reaching women, such as *Vogue* or *Har-*

pers' Bazar. I recall the case of a woman who secured over a hundred orders for such portraits by the discriminating use of the right sort of a letter and a carefully compiled list of well-to-do Wall Street men.

Using a List to Advantage

Such a list, which may be obtained in various ways, has many possibilities for the specialist. For example, there was the case of an ambitious amateur who had equipped himself with a model enlarging plant in the airy cellar of his suburban home, and wanted to make his camera pay his expense. To this end he prepared a letter offering to replace old and faded enlarged portraits with new and modern duplicates, framed in the tasteful fashion of today, at a price which afforded him a generous profit. Stress was laid on the assertion that the work offered was of a quality with which the ordinary enlarged portrait could not compete, and the price asked tended to support the claim. Finally the statement was made that the payment of the price was conditioned entirely on the customer's complete satisfaction with the finished work. The preparation of this letter took time and skill, since the success of the scheme depended so largely upon the impression it gave to the reader. It was sent out to a selected list of brokers, bank and railroad officials, in whose offices it was well calculated there would be the old and faded enlarged portraits of men worthy of replacement. The carefully thought out scheme met with complete and instantaneous success, bringing appointments for interviews which resulted in orders for over thirty framed enlargements at $35 apiece. This was only the first response to the letter mentioned; properly followed up, doubtless the results could have been largely increased. The enlarging process suited to this scheme may be found in THE PHOTO-MINIATURE No. 144 or No. 5 of the Big Six Series.

Home Portraiture

Some years ago I had a competition in portraiture for women workers only. It brought me many interesting pictures and, incidentally, a bit of very significant information that fits very well into the scheme of this number of THE PHOTO-MINIATURE. This information was that seventy-five per cent of my correspondents had entered the profession of photographic portraiture because of their profitable experiences as amateurs. In other words, these women had, as amateurs, acquired a certain measure of skill with the camera in home portraiture and found opportunities to turn their skill into money. Later, either forced by circumstances to earn a living or because of their growing interest in the work, they had one by one taken up portraiture as a profession. Some of these women are today holding an honorable place among our Fifth Avenue professionals, others have successful studios in their home towns. The point I want to make here is that many amateurs with spare time can find an easy way of making money with the camera in home portraiture. By home portraiture I here mean to include both portraiture in the home and out of doors.

What to Know

For success in this specialty the amateur needs not only a familiar knowledge of the essentials of portraiture and technical skill, but especially resourcefulness and the capacity to make the best of all sorts of conditions and environments. A thoroughly worked out scheme of procedure is another essential, that is, a definite plan of working. A practical knowledge of the possibilities of flashlight will also prove of great service if linked up to a reliable equipment for home work.

Text Books

The technical methods of home portraiture, indoors and out of doors, have been very clearly explained in THE PHOTO-MINIATURE Nos. 58, 65, 118, 127 and 141, all now out of print but gettable by persistent seeking and worth the seeking. The difficulties of indoor exposure are cleared away in No. 157 of this Series and flashlight photography is covered in Nos. 29 and 135. The photographing of children, at home or in the studio, is set forth in No. 152 of this Series. With the information and methods provided in these handbooks (and not obtainable elsewhere so far as I know) the reader should find no difficulty in acquiring all the skill needed to enable him to develop the local possibilities of home portraiture with complete success.

Getting Orders

Commissions for home portraiture are generally secured first among one's friends and acquaintances who have children, and later by circularizing a carefully prepared list of prospective customers. In the average small town it is not a difficult matter to get or make up lists of well to do residents who have children, or of families where there are invalids or old people to whom the journey to a professional studio offers practical difficulties. Another method of getting business is to circulate an album containing a wide selection of your home portrait work, with a request for an interview at which details and prices can be discussed. The distribution of a small attractive booklet is another plan which has proven successful. Such a booklet should set forth the attractions and advantages of the home portrait as compared with the average studio product and, if possible, be illustrated with a small photographic print reproduced from a selected example of your work.

Prices: Business Methods

A word of warning about prices may be helpful. Do not set too low an estimate upon your work by charging low prices, or making your prices lower than the local professional charges for similar work. This is not necessary as an inducement. Try to give the impression that your work is chiefly desirable because of its quality, that you can undertake only a limited number of commissions, and that you are in no way competing with the local professionals. The speculative plan has distinctive advantages with a certain class of prospective customers. It is easier to get commissions where one can arrange to go to the home as a friendly guest for a few hours and get pictures of the children as they play in the home or in the garden or about the house, on the understanding that finished prints will be submitted a few days after the visit, which may either be paid for at a pre-arranged price per print or returned at will. If the work is right the returned prints will not involve serious loss, and very often the offer of or reminder that you still hold such prints will bring orders from them for special use as Christmas or birthday gifts. From the accepted prints there will, of course, be after orders for duplicates. All of which notions, let me remind the reader, are not evolved out of my poor imagination, but are gathered from actual experience. For example, a well known woman worker, with an office in a big business building in a large city, does a prosperous business in home and outdoor portraiture on the speculative plan above mentioned. In another large town, noted for its industrial activities, a professional worker who had been obliged to relinquish his studio elsewhere by failing health, built up a considerable business in home portraiture by the booklet and album plan I have outlined in another paragraph. In short, the opportunities for making money with the camera, without interfering with your everyday occupation, are all around you and need but to be embraced to produce the extra money you desire.

Composite Groups

The composite group is another specialty which will repay cultivation by the amateur skilled in portraiture. This specialty is simply an agreeable way of making up an arrangement of single or individual portraits of the different members of a club or association or school or college class, so as to form a desirable souvenir of the club or group. To make such a group, first bring the idea before the officers of the club or association you have in mind, explain it clearly and show a diagram of the finished result. Quote your price and offer a framed print of the group to the club in return for its official endorsement of the idea and the necessary permission to work it out among the club members. This done, get the officers to make an announcement of your undertaking to the club at a general meeting, and arrange to have each member of the club or class attend at the place prepared for sittings on receipt of your call. Systematize your procedure, so that you get portraits of all the members uniform as to size and general style. Take the name and address of each member at the time of sitting. When all the portraits are completed, make a print from each negative and trim to a uniform size with an oval or rectangular cutting shape. Now plan a pleasing arrangement of all the portraits upon a large sheet of heavy mounting board, of a tint to harmonize with the tone of the prints. Mount the prints according to the carefully planned design on this board, giving a special place or arrangement to the officers of the group. This finished, large composite group is now carefully copied and reduced to a convenient size, such as 10 x 12, or a small negative is made from which enlargements 10 x 12 or larger can be obtained. The large original is framed and, with one of the smaller copies, presented to the officers of the club, with prices at which duplicates of the copies of the group can be obtained by the members of the club. If the venture is properly carried through by the coöperation of the club's officers, the order for copies of the group and orders from the original portrait negatives from which the composite group was made will bring a very profitable return for the outlay of time and skill required.

This specialty is one which many professionals can turn to profit, especially as far as large composite groups are concerned. But for small groups of less than twenty-five persons, it offers a money making opportunity well within the capacity of the amateur who has given attention to portraiture. A very special opportunity for composite group work is offered among the companies of military regiments now in formation.

Profitable Lantern Slide Making

A profitable side line, strangely neglected, is to be found in lantern slide making for lecturers and exhibitors. This specialty is well within the capacity of the average amateur and is peculiarly adapted for women who have free home time.

The Field

The use of the optical lantern or stereopticon is growing more rapidly than most of us appreciate. It is used in schools and colleges, in technical societies, in Sunday school work and in church services, in factories for the explanation of shop methods and processes, for the promotion of efficiency and the elimination of waste in production, in teaching such special lines as window dressing and branches of salesmanship, in advertising and political campaigns in big and little towns, for public and private lectures of all sorts, educational and social work by city departments, in masonic and fraternal society work, and more and more in the moving picture shows for announcement purposes.

Methods

The methods of making lantern slides, are most fully described, with all the formulas needed for their successful working, in THE PHOTO-MINIATURE No. 130. This is an out-of-print number, but I know of no handbook as good in practical information and helpfulness, so that it is worth seeking, even if you must pay double price for it when you find a copy. This applies with equal force to THE PHOTO-MINIATURE No. 83 on Coloring Lantern Slides.

An Unworked Gold Mine

Someday soon an enterprising amateur is going to make money with his camera in an entirely new variety of home portraiture. The specialty here outlined is an exception to those already given, in that it has not yet been proved out in actual experience. But I am convinced that it has money making possibilities, so I offer it here for what it is worth.

Flashlight Home Portraiture

Home portraiture, as thus far developed, means going to the home of the customer and there making portraits of individual subjects by the usual daylight methods. The new scheme of home portraiture here suggested is based on the use of flashlight for making home portrait groups at night. This scheme has two obvious advantages: the amateur has more free time in the evening than during the business day, and by doing the work at night he can get portrait groups of the family, including the members who are away from the home during the day, as well as groups portraying the intimate social or domestic life of the home, which obviously make a stronger appeal than the individual home portrait. The reader will readily agree with me that most families will look with favor upon the suggestion of a real home group which will include Dad and the boys and girls as well as the everyday stay-at-homes, giving them a picture of the home life for distant friends, or for after years' remembrance, altogether different from the usual professional family group. Then, too, the scheme includes all manner of home activities usually occupying the evening, such as supper or musical parties, or the friendly gatherings which form a big part of family life.

Equipment Possibly the reason why this sort of home portraiture has not received the attention it deserves, either from amateurs or professionals, may be found in the widespread ignorance concerning the flashlight apparatus and flashpowders in today's market. There have been many remarkable developments in this field of late, but the manufacturers have made but feeble efforts in making these developments known, selling their products chiefly to a few professionals, specialists, and large consumers. For example, the Prosch Mfg. Co., of New York, offers a wonderfully varied line of flashlamps and flashlight equipment, together with a flashpowder which is practically bottled sunlight. But the Company and its products are alike comparatively unknown to the great world of photographers who should be everyday users of the flashlight if they were familiar with its many profitable possibilities. Some of these possibilities are set forth, with working methods in THE PHOTO-MINIATURE No. 135, while flashlight portraiture in particular is dealt with from a professional viewpoint in No. 4 of the Bix Six handbooks, to which the reader is referred. They are the only handbooks on the subject at present available.

Getting Business Orders for flashlight home portrait work of the kind here suggested should be sought first among acquaintances by personal solicitation, with the help of a few good examples of the work. Later the field may profitably be developed by the use of a list of local residents, and an illustrated announcement or booklet carefully prepared in text and appearance to pull business.

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Enlarged Negatives and Transparencies

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From being something of an achievement in the old photographic days, an enlargement has come to be the most everyday of things. It is made with such facility and is often so difficult to distinguish from a picture made by contact from a negative that we are even now witnessing an extension of the meaning of the word "print" (in its photographic sense) to include also enlargements. You read "I printed so many enlargements." The phrase signifies more than the loose use of words. It marks the immense progress in photographic ways and means. We think no more nowadays of making our finished results four, ten, or twenty times the size of the negative than we did of laying the paper in the frame years ago, when we trembled for its existence as it passed through a succession of toning baths. Thus do revolutions silently come to pass, and thus have the paths of the photographic worker been rid of their rough places by modern invention.

But if enlarging and enlargements are new things which have created a new era in photography, we have restricted ourselves by choosing to work almost exclusively along the lines which have been spread before us so fascinatingly by the manufacturers. In other words, enlarging as a photographic process among amateurs has come to be almost completely the making of enlarged prints on development or bromide paper. Excellent as these materials are and beautiful as are the results which they afford, it must be remembered that there are others which are available if our enlarging is done by a method which is only a little more trouble and, moreover, returns for that little extra trouble quite a list of positive advantages.

This other method consists in the making of an enlarged negative which is then used, like any other negative, for the production of prints by contact. It is not a new method—in fact, in the early days of photography it was the only one—but it is one which has been largely neglected by the amateur worker, perhaps from a false impression of difficulties which actually have no existence. It was the subject of an early issue, No. 35, in The Photo-Miniature Series fifteen years ago, when special emphasis was laid upon the arrival of the small-size camera and its importance as a pastime, nay more, as a part of modern life.

Since then the small camera has become much smaller without any sacrifice of its value as a picture-taker, and now it is even more appropriate than it was in 1902 to present to photographers a monograph dealing comprehensively with the means of making from the present-day vest-pocket and still smaller negatives finished results which rank in every respect with those from the large and cumbrous apparatus of the past. In those means the enlarged negative has the chief place, but, apart from the end, forms a most interesting branch of work and utilizes to good advantage whatever knowledge of development, printing, etc., the good reader possesses. It calls for no really new manipulation—only for fresh applications of familiar processes—yet I can promise those who study and put into practice the instructions which follow perhaps more satisfaction in the way of fine pictures than they will get by doing any equivalent amount of photographic work.

Why an Enlarged Negative?

There are a number of answers to the question. In the first place the enlarged negative puts at our disposal the printing processes de luxe—carbon, platinum, Kallitype and plain silver paper, which are not rapid enough for enlarging direct. A more important advantage is the facility it affords of removing minor defects in the way of spots and specks and of carrying out larger modifications by working up parts of the subject. Of this, in a moment. Again, vignetting and masking are done more easily in accordance with one's exact requirements when working from an enlarged negative, and the same is true of the printing-in of clouds and skies, for which one system of making enlarged negatives is more suitable than any other process. And lastly, if a negative carries much pencil retouching, enlargement via a bigger negative is the best means of avoiding the exaggeration of retouching marks which so often is a disfigurement of professional enlarged portraits. A goodly list of advantages to set against the extra trouble, and even so it does not include the economy of time and labor when a dozen or more enlarged pictures are wanted from a single negative.

A Two-Step Process

In the making of an enlarged negative the first step is usually to make a positive transparency on glass (a diapositive). Several good methods dispense with it, but, broadly, it is the rule, and it provides the facility, mentioned in the previous paragraph, of touching out defects but chiefly of lightening masses of shadows by handwork on the back of the transparency. Think a moment and you will realize how much easier it is to do this when you can see, in positive form, the degree of modification you are introducing instead of having to guess at it as you have to do when working on a *negative.* Many workers who never could make a success with rubbing down a negative or working on its glass side find no difficulty in applying these same processes to a positive transparency.

At Stage 1, 2, or 3

And then there is always this to be remembered—that if any retouching is difficult on the original negative, it is correspondingly easy on the transparency. For example, black spots, which the professional treats with a knife, are white spots in the transparency and are easily touched out with the brush and opaque. And, again, such handwork as rubbing down density, which oftentimes is seen to be for the benefit of the transparency, can be postponed until the stage of the enlarged negative is reached when it takes the form of a little penciling or carmine wash on matt varnish on the glass side. This local addition of density is a much more speedy business than removal of density by friction, but one can take one's choice and work sometimes in one way and sometimes in another, whichever is seen to be the easier. I shall refer particularly to these methods of improvement at one stage or another on later pages, although the reader is no doubt familiar with them from the practical instructions in THE PHOTO-MINIATURE No. 143.

General Methods

The worst of telling how to make an enlarged negative is that there are so many different ways of doing it. You can ring the changes on the different methods of making the positive (usually a transparency) and the negative from it insomuch that the beginner is apt to be confused by a multitude of counsels. Putting aside those processes which dispense with the intermediate step and yield a negative directly from a negative—not the most reliable of processes—methods divide themselves into two classes. There are those in which one makes a print or transparency the same size as the negative and makes the enlarged negative from that; and those in which the enlargement is done when making the transparency and the negative made the same size as this latter. Inasmuch as different materials may be used at each stage of both of these systems, there are something like a dozen ways in which an enlarged negative may be made. It will aid us in getting a correct idea of the relative value, convenience, and economy of these processes at the start if we try to outline them in small compass by giving letters P1, P2, and so on, to the vailable methods for making the positive on glass or paper, and a similar series N1, N2, etc., to those for the enlarged negatives. In this species of shorthand we can then specify each working process and briefly describe its special features. I can think of no better plan of putting into a nutshell the rather spreading subject of this monograph before passing on to practical details. So here it is.

PROCESSES FOR POSITIVE TRANSPARENCY

Same size as original negative	Same size as enlarged negative
P1, dry-plate, or	P4, dry-plate, or Transferotype or development paper.
P2, carbon tissue, or	
P3, print-out paper	

PROCESSES FOR ENLARGED NEGATIVE

From positive same size as original negative	From positive same size as enlarged negative
N1, dry-plate or film, or	N3, dry-plate or film, or
N2, bromide, development, or Transferotype paper.	N4, bromide, development, or Transferotype paper, or
	N5, carbon tissue.

Now let us use these signs to indicate shortly the various combinations (for positive and negative) which make up each a complete process.

PRACTICAL PROCESSES

No.	Positive	Negative	
1	P1, dry-plate	N1, dry-plate or film	That most commonly used. All operations by artificial light.
2	P2, carbon tissue	N1, dry-plate or film	Also much used. In general more retentive of quality or original negative.
3	P1, dry-plate	N2, bromide, or development or Transferotype paper	Paper enlarged negative much slower in printing and of lesser "quality," but readily worked up with paper or stump.
4	P3, print-out paper	N1, dry-plate or film	Very quick and satisfactory processes, where large copying camera is available.
5	P3, print-out paper	N2, bromide paper or Transferotype	
6	P4, dry-plate, or development or Transferotype paper.	N3, dry-plate or film	More costly (two large plates) and requires large apparatus but more suitable for retouching, working-up, and insertion of clouds.
7	P4, dry-plate, development or Transferotype paper	N4, bromide paper Transferotype paper	Less costly than No. 6, but less suitable for addition of skies.
8	P4, dry-plate, development or Transferotype paper.	N5, carbon tissue	Least used process. No advantage over Nos. 6 and 7, but the reverse, except perhaps for commercial production of enlarged negatives, e. g., of clouds.

Transferotype paper is not obtainable in America. The use of bromide paper in all these processes is advised only on the score of economy. Practical experience proves that the enlarging development papers may be used with equal facility and yield equally good results. Dr. Mees, however, is of the opinion that the grain of either bromide or development papers militates against the successful use of paper for either transparencies or negatives, and he advises the use of Eastman Commercial flat films.—EDITOR.

Which Method?

All the methods in my list are capable of giving first-rate results, and I think that if I liked to take the trouble I could find a recommendation of each individual one by some worker of repute as the particular combination of processes favored by him. But in regard to that it needs to be remembered that different people have very different aims before them, and some are satisfied with a process which would fall short of the demands of others. Therefore let me give a few hints by way of supplementing the brief description of each process in the second table. Generally speaking, where all the quality of a fine original negative is to be retained in the enlarged negative, it is best to work from a transparency and to make the final negative on a dry-plate. Of the two methods, carbon tissue and dry-plate, for making a same-size transparency (methods 1 and 2), carbon secures that quality more automatically; the dry-plate, in addition to being much quicker, is better adapted for increasing or diminishing contrast as the original negative may require. From which the reader will understand that the use of a dry-plate, when the aim is to retain as nearly as possible just the contrast of the original, calls for some experience and judgment in exposure and development, but against this, half a dozen contact transparencies on dry-plates can be made in less time than is needed to complete a carbon transparency. Wherever a dry-plate is spoken of in these pages, it is understood to refer to one or another variety of the Eastman cut films available commercially, as well as to the glass dry-plate of everyday practice.

Large Transparency or Small? Whether we shall make one intermediate transparency the same size as the original negative or as the enlarged negative is a question the answer to which will depend, first, on the apparatus we have at disposal; second, on whether we want to combine another subject (say, a sky) into the enlarged negative; and, third, whether the greater cost of a large plate or film at both stages instead of at one only is a consideration. As to apparatus, there is almost as little trouble in making an enlarged transparency as a small one by contact printing, but when it comes to making a same-size negative from it, the practical difficulties call for more in the way of facilities than many workers have at their disposal. If you make your enlarged negative on film, such as the new Eastman flat films, these difficulties do not arise, for you can print by contact, pressing the sensitive film firmly against the transparency. But even so the contact method cuts out the chief advantage of the enlarged-transparency system, viz., the ready addition of a cloud or sky to the enlarged negative. On the other hand, when you use a dry-plate for the enlarged negative it won't do to print by contact for the reason that you can't depend on getting your two large glass plates into perfect contact everywhere, hence out-of-focus patches in the places where they don't touch. On this account the enlarged transparency requires to be reproduced same size—now we are at last coming to the question of apparatus—by copying it with a camera. A camera taking a plate as large as the transparency is needed, for which, as we shall see later, daylight is best. To many of us there is nothing formidable in these requirements. We happen to have a big camera—that it is an utter back number in design doesn't matter—and we have the place and the time to fit up the enlarged transparency against a clear sky. That being so, there is no better method for us or one more suitable for enlarging small negatives.

Enlarged Paper Negatives The use of bromide paper, or the special variety of it supplied to a comparatively small extent as "negative paper," instead of a plate for the making of an enlarged negative, offers certain positive conveniences. Apart from the much lower cost of paper in comparison with plates, it is very handy to be able to cut it to any size required. Also, a great deal can be done on the back of the paper negative with pencil or stump in the way chiefly of relieving heavy shadows. But, on the other hand, the paper negative is very much slower in printing and, moreover, has not the entire freedom from grain of a glass plate. This latter feature is not of much account since our printing will almost always be done on, at any rate, a matt paper—very frequently on one of distinctly rough surface. In printing on glossy or semi-glossy papers, however, a paper negative is liable to give a very unpleasing grain. With these limitations bromide paper affords a very useful and inexpensive means of making enlarged negatives, particularly if the transparency for it is right: the thin coating of emulsion on the paper, in conjunction with the opaque nature of the paper itself, makes it less easy to do much in the way of modifying the result by changes in development.

Paper Print and Glass Transparency

The plan of making a print on Solio or other print-out paper from the small negative and copying—enlarging that on to a dry-plate or bromide paper is one which is rather neglected. Except that it calls for a camera taking a plate the size of the enlarged negative, it is a first-rate process for the amateur whose negatives are of reasonably good printing quality. It is worthy of mention that that very capable worker, Dr. D'Arcy Power, of San Francisco, puts the method first in his favor as regards both results and convenience. He uses for the enlarged negative either a dry-plate or bromide paper, the latter in conjunction with an extra process to which I will refer when we come to the discussion of practical details.

Enlarged Negatives Direct

A number of processes have been devised for converting the (positive) image of a bromide enlargement into a negative by means somewhat similar to the reversing operation in the making of an Autochrome, that is to say, the positive image is dissolved away and the remaining emulsion developed to a negative. These are rather tricky processes to work, and changing from one brand of paper to another is apt to upset matters entirely. In the long run I doubt if there is any economy of material, and even when one has got a process working smoothly, the economy of time is less than would appear on account of the attention required by the successive operations. Moreover, this system does not offer the same facility for control of the result which any one of the two-step processes affords.

Apparatus I need not say a great deal under this head, at any rate as regards the making of an enlarged negative from a small transparency, because the apparatus in no way differs from that for enlarging from a negative and has been very fully dealt with recently in THE PHOTO-MINIATURE No. 144, "Enlarging on Development and Bromide Paper." It may be as simple or as elaborate as one may desire—a plain daylight box enlarger, a daylight enlarging lantern, or a room with a window fitted to take the plate and to permit the use of one's own camera. In the above number, and in No. 158 of this series, full details are given of such equipments.

But when working from a paper print or when copying an enlarged transparency same size, it is necessary to have a camera carrying a plate the size of the enlarged negative. Not that this need be very large. For negatives from vest-pocket cameras, 5 x 7 is about as large as one need have. Some negatives will stand a greater degree of enlargement, but, on the whole, it is best not to tax the definition too much. In any case this copying outfit need only be of very simple construction, in fact, the simpler, the better. It is enough if it consists of a rigid front and back, a baseboard which affords smooth focusing, and a plate-holder, fitted with one or two kits (carriers) for plates of various sizes. Daylight enlarging cameras, such as those of Gennert and Folmer and Schwing fill these requirements admirably. An old-pattern view camera which does everything that is required can often be picked up for a few dollars from the dealers in second-hand apparatus.

Method 1 Well now, after these preliminaries let us make a start with the process most generally used, viz., that of making a contact transparency on a dry-plate and enlarging that on to a second (large) dry-plate.

The Diapositive If your small negative is on glass, see to it that the printing frame is fitted with springs of good strength. Many of the frames on the market are supplied with flimsy springs. They may be strong enough for printing on paper but firmer pressure is needed to get two even small and thin glass plates in all-over contact. It is not a bad plan to buy a frame as sold for carbon printing, for which also firm pressure is of importance.

The Plate There is a reason for choosing a particular kind of plate, and it is that the diapositive which makes a good enlarged negative requires to be soft in contrast—in fact, flat. On no account should it have the look of a good brilliant lantern slide with glass—clear high lights and rich dark shadows. If you know something about lantern-slide making, carry in your mind's eye a slide that has had rather too much exposure and correspondingly short development—the kind of slide you would at once run the finger nail over and put aside for a cover glass—and you will have a pretty good idea of what you want in a diapositive for enlarging. In other words, the diapositive when laid on a page of small print should be distinctly gray in the high-lights, and the shadows should be only so dense that the type can be easily read through them. Now you can get this result on almost any plate, but most easily on a slow or medium emulsion as made for negatives and of speed about one quarter or one sixth that of the ultra rapid plate. Many use a diapositive or transparency plate, but I advise the beginner to leave it alone at first because it is made for brilliancy, and brilliancy is just what one wants to avoid. But if a negative is badly lacking in contrast—the kind which prints flat, say, on normal Velox—you can do with a plate which yields vigor more readily, and for this purpose you can use a diapositive plate to advantage, or even a process plate which is still more effective in making the most of a hopelessly flat negative.

Exposure and Development

A few feet from an ordinary electric bulb the exposure on a medium speed plate will be only a second or two, but it is better to stand the frame far enough away to require at least five seconds' exposure. If that is too long or too short you then have something definite to go on in making a further trial, whereas it is not easy to time very much shorter exposures with anything like exactness. As a general rule it is better to err on the side of ample exposure.

The developer should be one of the soft-working type—not pyro or hydroquinone—which brings out detail everywhere first and builds up vigor slowly afterward.

The single-solution developers (paramidophenol) now sold as Kodol, Azol, etc., are very good for the purpose, in strength of about 1 in 20. Also developers of the metol type. Elon, Monomet, and quite a number of others evolved in substitution for German metol are likewise specially suitable. The following Monomet formula yields a nice soft transparency: Monomet, 20 grs.; soda carbonate cryst., 240 grs.; potass bromide, 2 to 4 grs.; water, 20 ozs.; fixing, washing, and drying are as usual. Some of the largest users of metol in pre-war days are now using the new agent Mitus with complete success in this branch of work.

Enlarging from the Diapositive

For enlargement, this finished transparency is treated just as though it were a negative, but in place of the bromide paper a dry-plate is placed in the enlarging box or camera. On the easel, when using an enlarging lantern, the plate is fixed in position with three or four push-pins. Here, again, the best choice for the beginner is a slow negative plate, with which he will easily get quite enough contrast in the enlarged negative—and not too easily—by the developers just mentioned. But when a little experience has been gained, a lantern-plate or an extra-rapid plate will be found equally of service.

Of the two I prefer the latter for printing quality in the negative, and if you set store by lightness and non-liability to breakage of the enlarged negative, you can get results which leave nothing to be desired on cut film. For these, my experience is that pyro-soda is the best developer, but with about half the quantity of pyro that is prescribed for negatives made in everyday work direct in the camera.

Development

I promise the reader that he will find the development of enlarged negatives a far more fascinating process than that of dealing similarly with the original camera exposures. What with developing tanks and machines, the joy of seeing the invisible image build itself up before one's eyes has largely passed out of photographic experience. In restoring it, the making of enlarged negatives adds a new pleasure to camera work and at the same time permits the photographer to acquire an art which is in danger of being lost—the art of developing by judgment. It is only natural, in dealing with small negatives (on fast plates or film), the very subjects of which it is by no means easy to identify in the dark-room light, that one should gladly avail oneself of the time system of development in a tank with its high average of results. It relieves one of much tedious work, and then there is always a printing paper for every negative which is anything like passable. But it is different with the plates from 5 x 7 to, say, 12 x 15 size which one makes with the object of printing in carbon or platinum and requires to be of quality according. There is no purpose in adopting all the ways of "tinkering" with the developer which were in common use when pyro-ammonia was the universal developer. It is enough to rely on two factors of control—one the continuance of development until it is judged that a sufficient degree of contrast has been secured; the other, the adddition of a little more of the developer proper (pyro, metol, Mitus, or the like) if it is seen that this process hangs fire. In carrying out development on these lines, stick to one plate and developer and know both—that is, know to what degree, if any, you require to push development beyond the point at which the vigor looks strong enough when the plate is held up to the dark-room safelight. The slow negative plates already recommended will stand the bright ruby light which makes such judgment easy, and, moreover, plates of this comparatively slow speed develop vigor steadily and regularly as development proceeds. In this respect they differ sharply from many ultra-rapid emulsions which can be seen to gain density up to a moderate degree and then seem to get no further, although the process is nevertheless going on and often is found to have resulted in an astonishing degree of contrast after fixing is complete.

Method 2

Now I come to my second method. This differs from the one so far considered only in the fact that the same-size transparency is made by the carbon process instead of on a dry-plate. As I have already said, this process is more automatic than that with the dry-plate. It yields in the transparency all the quality of the original negative, and if that quality is excellent there is no better method, none indeed quite so good. In other words, if your negatives are of the thin, clear brilliant kind which enlarge well on bromide paper without the need of any dodging, carbon transparencies from them will yield enlarged negatives (and prints therefrom) which will be as good as they can be made.

The Carbon Transparency

The materials for making carbon transparencies do not make a formidable list: Carbon tissue (the "special transparency," kind), an actinometer, squeegee, glass plates, and for chemicals—bichromate, alcohol, chrome alum, gelatine—and hot water. By far the best plan for sensitizing the tissue is to use a quick-drying sensitizer such as the Autotype Co.'s, sold ready for use, or one prepared at home by mixing one part of 20 per cent solution of ammonium bichromate with three parts of absolute (ethyl) alcohol. The tissue is simply brushed over, first one way and then another, with the sensitizer, using as "brush" a strip of flannelette attached to a slip of glass with a rubber band. By the time three or four pieces have been done, the first is ready to be resensitized, and within a quarter of an hour is dry and ready for printing. Thus at one step you cut out all the troubles which come from faulty drying of the tissue and besides have no need to sensitize overnight and possibly to waste time and material. The glass plates to receive the picture from the printed tissue require to be coated in advance with a substratum of gelatine. This is done by means of a solution prepared by soaking 120 grains of hard gelatine in 20 ozs. of water until swollen, dissolving by standing the vessel in hot water and then adding slowly and with stirring 30 grains of chrome alum dissolved in 1 oz. of water. This mixture is simply poured on and off the cleaned glass plates (old negatives) which are then stood aside to dry, away from dust. They may be kept indefinitely; best stood between sheets of tissue paper.

Printing the Tissue

As in all carbon printing the negative requires to be provided with a "safe edge," i. e., a narrow band of adhesive binding fixed on the glass side so as to yield an unexposed margin on the tissue. No visible image being produced on the tissue by the action of light, it is necessary to time the printing by an actinometer. The simplest pattern consists of a box through a slit in the lid of which a strip of Solio paper is drawn under a "tint." The paper is exposed to light (alongside the carbon tissue under the negative) until it matches the "tint," the strip being then drawn forward, a further portion again exposed to the depth of the tint, and this process continued according as it is judged that the negative is of such density as to require 2, 3, or 4 "tints." A little experience will soon enable the worker to "size up" a negative as regards the number of tints it requires, but in his first attempts he may take to his aid a negative as near in density to the one in use as he can select and expose under it in another frame a sheet of Solio paper. Carbon tissue printing about twice as quickly as the silver print-out paper, the tissue will be fully exposed when the Solio print under the other negative is about half finished.

Transfer and Development

As soon as printed the tissue is laid, face down, in a dish of cold water and, at the same time, one of the gelatine-coated glasses put to soak, face up, in a second dish.

In a few seconds the tissue straightens itself out and then begins to curl over at the edges. It is at once laid, face down, on the glass plate (still under the water) and the two lifted out together. The glass plate is laid on several thicknesses of blotting paper, and the tissue lightly squeegeed down on to it with a few to-and-fro strokes of a bar squeegee. The whole is then left under light pressure—a pound or so—for about an hour, when the tissue is ready for development.

The plate is put to soak in water at about 100° F. until the dark pigment is seen to be oozing slightly from around the edges of the paper. On then raising one corner of the tissue the paper backing is stripped away. The picture on the glass now steadily develops as the dish is rocked or the hot water poured over it from a cup. If the transparency looks too dense from over-printing, hotter water up to 110° to 120° can be used, but there is danger of causing a leather-like marking (reticulation) throughout the coating. When development has reached the stage at which all shadow details are clearly visible, even though the high-lights are not clear glass—they should not be—all that remains to be done is to rinse the plate in cold water for about 5 minutes and set it to dry.

Enlarging the Carbon Transparency

In enlarging a carbon diapositive the method is exactly that used with a dry-plate transparency—with one important reservation. It should not be enlarged in a condenser lantern which is not fitted with ground glass in front of or behind the condensers. This is because the carbon image is in (slight) relief on the plate and in the use of the direct point-to-point light, such as that of a lantern with an unscreened condenser, the minute elevations and depressions of the gelatine film are liable to cause markings in the nature of fine light or dark bands along the outlines of the subject. In fact, depending on the degree of concentration of the source of light, the use of a ground-glass screen in a condenser lantern may not be enough to overcome this defect. The most effective place for it is as near the light as it can be put but, generally speaking, a daylight enlarger is the best for carbon transparencies or, if artificial light is to be used, one of the patterns in which the light is diffused as thoroughly as possible and in which no condenser is used.

Remember, too, that a carbon transparency is reversed as regards right and left, and therefore in making an ordinary enlarged negative it requires to be put into the enlarger glass side toward the lens. If it is intended to use the enlarged negative for carbon printing by the single transfer process, it is put in, film side—toward the lens. In these circumstances a dry-plate positive needs to be placed with its glass side toward the lens, the object in both cases being to secure a negative which is reversed as regards right and left and thus yields carbon prints—which are the right way about—without the trouble of double transfer. There is nothing in all this to call for any extra precaution in using an enlarger where you focus the enlargement sharp on an easel, but if it is one of the fixed-focus pattern it won't do to omit an allowance for turning the positive glass side outward. The frame on which the negative rests in such an enlarging box requires to be cut down to the extent of the thickness of the glass, otherwise the enlargement will be out of focus.

Method 3

Now I come to a method which has much to recommend it to the amateur worker, for it is inexpensive and is one by which you can choose the shape of your enlarged negative exactly according to the particular little bit of a negative which is found to contain "the picture." It consists in making the diapositive on a dry-plate or on carbon tissue, as in Methods 1 and 2, but using for the enlarged negative bromide paper or some one of the many development papers offered for enlarging purposes. Eastman's Bromide Paper No. 1 is excellent. These paper negatives have their good and bad points. While they are unbreakable and light in weight, they are slow in printing. Not that their capacity in comparison with a glass negative matters much where good summer light is available for printing, but the dweller in latitudes where dull weather, coupled with a damp atmosphere, is the portion for pretty nearly half the year, will find it a serious handicap in printing from them in platinum or carbon. Also such paper negatives call for a matt-surface paper for the prints from them: the grain of the paper is apt to imprint itself along with the picture if a glossy or semi-glossy printing paper is used. But this is not a real drawback since one almost always chooses a matt, often a canvas or rough surface, for the enlarged prints. And, on the other hand, the paper negative scores in the ease with which its plain side may be touched with pencil, crayon, or stump (stomp) in the way of strengthening shadow detail, putting in accents, and otherwise pulling together the elements of a composition.

The Bromide Paper

It is necessary to choose with care from the many varieties of bromide paper on the market. The paper should be of the thinnest substance, one maker's "thin" differing to a marked degree from another's. As to surface, the glossy papers are the most free from grain, but do not lend themselves to pencil work on the coated side. The platino-matt papers, on the other hand, take pencil well and are little inferior to the glossy papers in fineness of grain. I advise the beginner to choose among papers of this kind, selecting as thin a one as he can find. One of the thinnest which I have come across from either an American or British maker is the thin "Rexo," but there may be others coated on a base of equally light weight. I have used Enlarging Cyko and Azo papers successfully although the grain is always evident in prints smaller than 10 x 12 inches.

Negative Paper

The thin, fine-grained, tough paper, coated with an emulsion like that of bromide paper, is the feature of this material which is not an unmixed blessing. One has to be very careful not to "kink" the paper in handling the wet negatives. If you crease the prints by anything like rough handling, you make marks which show on the prints, even if the kinks do not start blistering of the gelatine coating. At any rate, that is my experience with negative paper, and it decides me in using and recommending the ordinary bromide paper. Moreover, negative paper is not stocked by many dealers, even in Britain, and in the United States it is not in the market at all as far as I know. On all counts, therefore, it is better to choose a bromide or development paper such as I have indicated. You can buy them anywhere, and any large-size sheets unused in the making of enlarged negatives can always be cut up for contact printing.

Developing Paper Negatives

The exposed bromide paper must not be developed like a positive enlargement or the negative will be disappointing from its lack of vigor. In a positive print we are concerned only with getting a vigorous picture on the surface of the paper, but in an enlarged negative the image requires to penetrate down into the emulsion coating. The test for this in developing is to judge the negative by holding it up to the light of the dark-room lamp, and it will be found that development requires to be considerably longer than for positive enlargements. As a rule, development should never be for a shorter time than five minutes—and may often take longer. If, with the formulas given below, longer than ten or at the most fifteen minutes is required, it is a sign that exposure has been insufficient, and that is bad for the negative, since forcing an under-exposure in this way means poor gradation as well as exaggeration of the grain of the paper in the negative. You need to expose so that the image comes up readily and attains satisfactory vigor with, say, ten minutes.

Developers

For my own part I have been as well satisfied with the pyro-soda developer as with any other for the making of paper negatives, but I use it rather weak, about half the strength which is the rule in ordinary negative work, that is to say, from 1 to 1½ grains of pyro per ounce of the working developer. A good formula is: A. Potass metabisulphite, 30 grs.; pyro, ¼oz.; water, 20 ozs. B. Soda carbonate cryst., 2 ozs.; soda sulphite cryst., 2 ozs.; potass bromide, 10 grs.; water, 20 ozs. Working developer: A solution, 1 oz.; B solution, 1 oz.; water, 20 ozs. With development papers a non-staining developer such as Kodelon or Mitus is advised. Another good developer is: soda sulphite, 100 grs., dissolved in 4 ozs. water and with 12 grs. amidol added at the time of use. It is better to dissolve the sulphite also on the day the work is done. With either of these developers a drop or two of 10 per cent solution of potass bromide may be added if there is any tendency of the paper to fog or veil in the shadows.

Making Transparent

Except under the exceptional conditions just mentioned I do not think it is worth while going to the trouble of making the paper negatives more transparent. Even with the best that can be done with this "translucing" process, the negative is still a good deal slower in printing than one on glass. However, for those who want to try what this treatment will do, here are the formulas: (1) Castor oil, 1 oz.; alcohol, 4 ozs. This is brushed over the paper side of the negative, given a few hours to sink in, and a second coating applied if necessary. (2) Equal parts of terebene and salad oil make a mixture which is used in the same way. Both of these are fairly lasting in their effect, but a readier method (3) is just to rub the negative over with a rag moistened with ordinary kerosene (lamp oil). This takes a day or so to soak in, and the transparency goes off after a while, but it is about the handiest of these methods.

Methods 4 and 5

I class these together because they differ only in the use of a dry-plate in the one case and bromide paper in the other for the enlarged negative. But the essential part of each method is the use, for the small positive, of an untoned unfixed print on Solio or other print-out paper (Anglice P. O. P.). Of all the methods described in this monograph it is, I think, the quickest, and it is certainly quite high in the list as regards the quality of the results obtained with reasonable care.

The Solio Print

You have first to make your print on a glossy or semi-glossy grade of Solio, but not to the extra depth which is necessary when prints are to be toned. Just take the printing only as far as "looks right," i. e., just to that stage at which the picture has that fresh, brilliant appearance in the printing frame which we admire at the time and never quite realize after toning and fixing have been completed. Having done this, put the print aside in a book, or somewhere quite in the dark, and proceed to make all in readiness for copying-enlarging it so that during the actual photographing it shall be exposed to light for the least time.

Copying-Enlarging

For this purpose cut out a bit of newspaper the size of the print, pin it up to the easel, and focus as sharply as you can, using a magnifier. The newspaper type will enable you to tell much better than when working from the actual print when you have got sharp focus over the whole screen. Usually there is no better lens for this job than that from the camera with which the small negative was taken, that is to say, if it is of fairly high grade. If it is an anastigmat or R. R. of aperture *f*/4.5 to *f*/8 it will do excellently: if it is of lower grade, you will probably find that it can't be detached from the camera. Anyway, these cheap lenses are unsuitable, as their low speed requires considerable time of exposure, and it is necessary to avoid that in working from an original which is still sensitive to light. Where no camera lens can be made available, about the best choice is a 4-inch or 4½-inch R. R. of *f*/8 aperture for use with negatives up to about 3 x 4 inches.

The temporary original is fixed up in an ordinary room where it will get moderate diffused light (never sunshine), or the copying can be done just as well at night with a pair of nitro bulbs, well screened on the camera side so that their light cannot strike dirctly on the lens. Having got the focus right and the plate (medium landscape) in readiness in the holder, pin up the Solio print over the piece of newspaper, take a look at the focusing screen to see that the enlarged picture is properly placed, insert the plate-holder and expose—which usually will not be longer than a minute and may be much less than this. The remaining part of the process is the development of the plate (or bromide paper) just as when working from a transparency.

Large-Transparency Process

In now further pursuing the scheme of processes set forth on page 305, we come to those methods in which the enlarging is done in making the transparency, which latter is then reproduced same size in negative form. I have already dwelt on the special merits of this system of working, and I will tell directly how they are secured in practice. Meanwhile, let it be said that it is this form of process which is most highly favored by practical photographers whose work commands admiration for its "photographic quality." None, perhaps, stands higher in this class than W. R. Bland, who a year or two ago declared that an article in a photographic journal recommending this system had repaid him for his twenty years' subscription.

Apparatus

Well, as has already been said, it is a method which makes more demands in the way of apparatus, although if my reader has some natural ingenuity, a dollar or two well spent on tools and wood will save him the cost of a large-size camera, always providing, as the lawyers say, that certain facilities can be provided at home.

The enlarged positive has to be made on a dry-plate and calls for nothing different from the apparatus you would use in enlarging on to bromide paper. The dry-plate is attached to the easel or put in a holder even more easily than the sheet of paper. But if you are going to make your large negative also on a dry-plate (Method 6, page 305, and the best of all the methods at present available), you need to photograph the diapositive, that is to say, to copy it same size.

The handiest way of doing that is by the use of an enlarging camera such as the Soldak of G. Gennert or the F. & S. Graflex and Crown of the Eastman Kodak Co. The baseboard is fitted with a frame to carry the transparency, the sensitive plate for the negative is carried in the holder, and the whole apparatus can be tilted to a clear sky so that the diapositive is properly illuminated. Really, the outfits just named are more elaborate than they need be for this particular purpose. If you can get an old pattern view camera of 8 x 10 or 10 x 12 size it will serve you almost as well. You need only fit it to a slotted board to one end of which you fix an upright frame to hold the diapositive central with the camera lens.

If you can get the use of a room to serve as a camera you can do just as well with a still more primitive arrangement. Let us suppose you can arrange to fit to the window a shutter which is light-tight except for an opening which just takes your positive transparency. Then your only other needful apparatus is any box or tunnel one end of which—an open end—butts light-tight against the transparency, whilst the other is closed and carries the lens. This tunnel may be a simple rigid box of length (as found by trial) to give a projection the same size as the transparency. This length will be about twice the focal length of your lens, but you require to try it out.

While you are about it, it is just as well to make the tunnel of variable extension by having it consist of one box sliding within another. The rear box is made open at both ends and is secured light-tight against the window shutter, as can easily be done by providing it with a kind of flange piece which is screwed to the shutter with a thickness of felt between the two. The forward box is made of size just to push over the other and can thus be pulled in or out for any greater or smaller degree of enlargement which one may fancy. The picture is focused by moving the easel, which serves to carry the large dry-plate, back and forth between a pair of guide strips. I realize that the whole arrangement may seem, from this description, to be hopelessly primitive, but let me assure the reader that an outfit almost exactly on these lines is used by a firm of professional enlargers whose work is a standard of excellence. They ought to be ashamed of themselves, perhaps, but there it is. It is not necessary to prescribe dimensions; except as regards length, the size does not matter much. For a double-extension box the length of each part should be about one and one-fourth times the focal length of the lens. This will give an overlap, to the extent of half a focal length, of one box over the other when copying same size, whilst enlargement up to about four times (4 x 5 to 16 x 20) can be done with the forward box pushed home.

The Enlarged Transparency

What I have already said about making a same-size transparency by contact applies pretty well to producing the transparency by enlarging. You need to guard against getting too much contrast. The large transparency may well have somewhat more pluck than one which is afterward to be enlarged, but it is necessary to avoid heavy, dense deposit in the shadows, coupled with bare film in the high-lights. So here, too, a medium speed or landscape plate is the best choice if your negatives are of fairly good quality: if they are poor in the way of flatness you may use with advantage a lantern or "process" plate. Whichever you use, you have still a fair amount of control at disposal in the degree to which development is continued, as also in giving the finished positive a touch of extra vigor with a mild intensifier such as the mercury iodide, chromium, or mercury and sulphite. Any intense intensifier like mercury and ammonia is quite unsuitable. In this connection I commend to the reader's study the advice on intensification contained in "Remedies for Defective Negatives," The PHOTO-MINIATURE No. 143.

Improving the Transparency

But such intensification is by no means all that may be done: in fact, there is no need to do it at all if exposure and development have been matched to each other and to the negative. It is in this method of making an enlarged negative—and precisely at this stage—that the opportunity chiefly exists for eliminating from the final result any features of the original negative which pictorially are unfortunate. Here, in particular, is a fascinating branch of work which is within the scope of the beginner. For certain kinds of this improvement work can be wiped out and done afresh, and at the worst it is no great matter to make a second enlarged diapositive. So at this point let me tell the chief ways in which a subject which has elements of attractiveness in it may further be helped along its course to a pictorial end.

Ugly Shadow Masses

One common effect of enlargement is the accentuation of masses of shadow. These dark passages, owing to their small area, will escape being disfigurements of a small print but when, in the enlargement, they cover a space ten or twenty times as great, they may easily be an eyesore. Moreover, in enlargements from snap-shot negatives the shadows are often destitute of gradation and thus call all the more for appropriate treatment before we commit ourselves to the final stage of the process—the enlarged negatives.

This treatment of the transparency which is seen to require it is a very simple dodge of the days when direct negatives of large size were the rule instead of the exception. It consists in rubbing down the excessive density with smooth chamois leather very slightly moistened with alcohol. To avoid breaking the transparency—for it is necessary to apply some force in rubbing—it is laid on two or three thicknesses of blotting paper which in turn rest on a sheet of glass. It is better to stick to the plain spirit-moistened leather rather than take advantage of the quicker means which are available in the shape of abrasive paste or pencils. As a rule, not much reducing action is called for, so it is easy to overdo it. You will find that by this abrasive method you can remedy such small patches of excessive density which occur between openings in foliage in a landscape, or larger areas like a dark foreground or the shadow side of a tree trunk or building. Where the area is large the pictorial aim will often be achieved by breaking up the one tone into several, taking as a guide such indications as may exist—though faintly—in the enlarged transparency. This method serves usefully in introducing light accents in places where it is seen that they will pull the composition together, as also in clearing away clouds from a diapositive which it it is intended to combine with a separate cloud positive as directed in a later paragraph.

A General Method

But still more can be done for the pictorial improvement of our final result by working upon the glass side of the enlarged transparency. This process can be carried out step by step, and, if the effect be thought not good, can be discarded and a fresh scheme adopted without sacrificing the large diapositive. The easiest means of putting this method into practice is to coat the glass side of the positive with a mixture of equal parts of (1) 2 per cent solution of celluloid in amyl acetate and (2) best methylated or denatured alcohol. Flowed on the glass like a cold varnish, this gives a perfectly transparent coating which can be worked on with pencil or finest graphite applied with a stump. Think awhile and you will realize what can be done by this means. It is preëminently suited for dealing with glaring high-lights and for emphasizing shadows. Touches of pencil or powder in the appropriate places effect either. The thickness of the glass softens off the outlines of the work when the negative comes to be made, whilst the effect of every touch is seen on holding the diapositive up to the light or, better, viewing it on a retouching desk. Neither I nor anyone can tell the reader what to do in the way of thus strengthening dark or medium tones or lowering high-lights. Only a sense of what the subject demands for its artistic salvation can tell him that. Sufficient that I indicate a means which is within the capacity of the prentice hand, inasmuch as a first unsatisfactory attempt can be cleared off (with absorbent cotton wet with amyl acetate) and something better done at the next trial. With this constant boon, too, that the man or woman who is seeking art by way of photography can show these attempts to some artist friend and get his advice at the stage at which it can be taken. We all of us have experienced the hopelessness of expecting an artistic criticism of a *negative:* which is another reason for making the enlarged transparency the half way house to the negative—that is to realize our artistic aims.

The Negative And now to go back to the making of this final negative. I have already described the apparatus which is needed. In using it, see that the transparency is evenly lighted. For this, in most cases, it is necessary that the light should reach it from a matt white reflector fixed at an angle of 45° to the transparency. Nothing is better as a reflector than white blotting paper, such as Photo Finish World. If your eye, from the position of the easel and looking through the frame which holds the transparency, sees only clear sky, you can dispense with the reflector, but if its view includes surrounding buildings, the illumination is thereby rendered uneven and you need to make use of the light from the overhead sky, obtaining it (reflected and diffused) from your angled blotting paper. Such an arrangement, fortunately, is possible, however confined the outlook from one's house or flat may be. As plate for the negative, once more choice is best made among those of the "slow ordinary" or "landscape" grade, which develop cleanly and lend themselves readily to any degree of softness or vigor which one may elect to secure in the negative by short or prolonged development. It is scarcely necessary to remind the reader that a negative intended for printing by the carbon process requires to be of strength considerably greater than is good for the making of bromides, and somewhat more contrasty than those for platinotype which actually calls for very little additional pluck in comparison with those for rapid silver papers, so long as they are free from general veil and have just a little deposit over the shadow portions. As developer, with a view to this control of vigor, there is, I think, no better formula than pyro-soda, as already given on page 318.

Skies and Clouds

Before I refer briefly to the use of bromide paper or carbon tissue (Methods 7 or 8) for the making of the enlarged negative, I must come here to the insertion of a cloud or sky, since the method of copying the large transparency with a lens is the best of all for this purpose. In a word, the process consists in making a composite transparency of landscape and sky, and copying each on a separate plate. Here is how to go about it—simple and certain in the extreme. Having completed your landscape transparency, make one of the same size from the cloud negative. In doing this bear in mind that the two plates are to be bound together, film to film, and that therefore the cloud negative, if (as it should be) it is lighted from the same direction as the landscape, requires to be turned the other way about in the enlarging lantern: or you may use, in the ordinary way, a cloud negative in which the lighting is opposite to that in the landscape. Anyway get your cloud transparency of a kind to suit the landscape. After fixing and washing, hold the two transparencies, back to back (with the edges of the two plates in exact register), and with absorbent cotton wet with iodine-cyanide reducer wipe away that part of the image on the sky negative which extends below the sky-line of the landscape. The iodine-cyanide reducer is made by adding about 5 drams 10 per cent solution of iodine (in potass iodide) and 1 dram 10 per cent potass cyanide solution to 10 ozs. of water. The cyanide solution, remember, is intensely poisonous and should be kept under lock and key. The mixture rapidly wipes out the image on the plate and should therefore be used with caution near to the sky line, and, of course, with the plates held the right way up so that no reducer can run on the cloud image which is left. Then give the cloud transparency a further wash—for fifteen or twenty minutes—set it to dry, and bind it, film to film, with the landscape diapositive. This composite transparency is then ready for copying as directed in the preceding paragraph.

On Paper

The making of the negative (from the large transparency) on bromide paper has this to recommend it—it can be done by contact in a large printing frame, since the paper can be pressed evenly against all parts of the transparency. Thus, this method is one which is rapid, calls for nothing special in the way of apparatus, and provides the opportunity for all the handwork you can want, not only at the transparency stage, but in the paper negative itself. As regards the making of the paper negative there is nothing to add to the hints already given in making the enlarged negative on bromide paper according to Method 3.

Carbon Negatives

In comparison with a dry-plate or with bromide paper the use of carbon tissue for the enlarged negative is a slow process; but it has the advantage over the former of dispensing with a copying camera, and over the latter of yielding a perfectly transparent negative which may be made at choice on glass or celluloid. Since the picture is obtained reversed as regards right and left when printing from the diapositive, allowance needs to be made for the fact when enlarging the negative. Also, the enlarged diapositive requires to be of greater pluck—hard in comparison with that for other processes—in order to yield a good printing negative. While the method is a favorite with professional makers of carbon enlargements, largely because it utilizes the same materials and process, I should say it is the least used by amateurs of any I have included in my list, although the results are beyond criticism as regards quality. Those who are adepts at carbon printing will make good use of their skill, but there is no real inducement to become proficient in carbon printing solely for the purpose of making enlarged negatives.

Window Transparencies

Now I come to a branch of work which is almost completely neglected by present day amateurs, although it is only the making of enlargements of another kind. It is a pity that the large transparency has never attracted my amateur friends, for it is a supremely beautiful form of photograph: I would almost say that no print is capable of yielding such rich effects—brilliant lights and luminous shadows—as a well made and properly illuminated transparency. Of late this kind of photograph has gained a place as an instrument in the hands of advertisers, for whom some magnificent specimens have been made, such as Rau's fine, colored transparencies at the Pennsylvania Terminal, New York. The amateur needs to realize the fascination of this work and the great use to which the results can be put in home decoration.

A Suitable Negative

So far as its quality is concerned, a negative which yields a good lantern slide or a first-rate Solio print is all one can want as the original for a window transparency. But the kind of subject is equally important. The results from those which are crowded with much detail are disappointing. A window transparency is usually not larger than 8 x 10 or 10 x 12 inches, but it is mostly viewed from a distance of something like 10 feet, whereas a print is held in the hand and examined from a distance of as many inches only. Hence the most suitable subjects are those of a broad, big character, such as studies of sea and sky, large portrait heads, flowers, architectural bits (not whole interiors). In other words, subjects which are conceived in broad masses. Subjects such as a flower garden or the general view of a village or riverside, in which a good deal is included and all on a small scale, make a poor show. As a test of suitability, pin a score or so of prints from your small negatives to a board and note which of them continue to stand out as you step further and further back. Other things being equal, these will be the best for window transparencies. Often a 1 x 2 inch bit from a much bigger negative enlarged six or seven times will yield just the broad effect which is wanted.

Processes

The handiest method of preparing transparencies is by enlarging on to a plate coated with lantern or diapositive emulsion. These are made up to the largest sizes. The carbon process, with its range of fine colors, is the process *de luxe* for the purpose, requiring only the preliminary making of an enlarged negative. Even bromide paper can be turned to good account by making an ordinary enlargement and rendering it semi-transparent. The prints are quite transparent enough for window display and dispense with the ground glass which is needed for those by the other processes. Eastman Positive, and Process Films, and the Velox Transparency Films are also suitable and perhaps preferable to paper.

Lantern Plates

A window transparency is pretty much the same as a lantern slide and should have the same characteristics of transparency in the shadows and perfect clearness in a few points of high light. These qualities are easily secured on any of the commercial lantern plates, but in the making of large transparencies we can do with considerably more vigor and density, and therefore the rule should be to give an exposure on the full side and to develop further than you would a lantern slide. The high lights of the subject should show quite a distinct veil over them and the shadows appear to be choking up before taking the plate out of the developer. The finished transparency will then be right; if it should turn out too dense a few seconds in very weak Farmer reducer will put it right. I prescribe no special developing formula: use that directed by the makers. It will be compounded to give richness and brilliance in conjunction with a lantern emulsion. Whatever you do, don't confuse the instruction given on an earlier page for the preparation of transparencies for enlarging with those for making them for showing in a window frame. The two transparencies are completely different in character and require different treatment.

Carbon Transparencies

The instructions for the printing of carbon tissue already given apply equally to the making of window transparencies, providing that an enlarged negative of sufficient vigor has been made. The negative requires to be of much greater printing strength than for silver print-out or development papers and is easily adjusted when developing the large plate. If the reader is using an existing large negative, he can remedy much lack of vigor by using a weak sensitizing bath; but on the grounds of speed and certainty I advise him to use the spirit sensitizer, although this latter does not lend itself to such compensation for the negative.

Bromide Paper

The use of a *thin* bromide paper for making transparencies deserves to be better known than it is. The method is cheap and the results very effective. The paper requires to be given a full exposure and development continued until the picture is almost buried in density, otherwise the transparency will be altogether too pale and weak. The finished and dried prints are then rendered semi-transparent by painting the backs with a mixture of 1 oz. Canada balsam and 4 ozs. turpentine, leaving them hung up overnight. This yellows the paper slightly and so the most pleasing effects are gotten by sulphide-toning the prints or re-developing, the sepia color serving, by contrast, to mask the slight yellowish tint of the prints.

Binding Transparencies

The proper way to bind a transparency with the ground glass which is necessary to form a background for the picture is to place the cover glass ground side out. If, as is often done, the ground surface of the glass is placed in contact with the image side of the transparency plate, the grain of the diffusing medium is too distinctly seen. Indeed, if the ground glass is none too fine in the grain, it is just as well to put a sheet of plain glass between it and the transparency so that the latter is separated from the ground surface by two thicknesses of glass. The two (or three) glasses—all perfectly dried by warming—should be bound together with passe-partout adhesive strip, which should afterward be run over with celluloid varnish in order to make a waterproof seal. These transparencies are often placed in positions where the dampness of the air fluctuates greatly, wherefor it is well to enclose them thoroughly as a preventive against the entrance of moisture. The "transparentized" bromide enlargements require only to be bound between two sheets of plain glass in the same manner.

EDITORIAL NOTE

The attention of the reader is called to the announcement of the Wanamaker Photographic Exhibitions, among the advertisements of this issue. Entries for the November, 1917, exhibition must be delivered in Philadelphia before October 13th next. For the March, 1918, exhibition, entries close February 9, 1918. Detailed information can be had from the Photographic Exhibition Bureau, John Wanamaker, Philadelphia. Cash prizes are offered in both exhibitions.

Photography in Time of War

[OFFICIAL COMMUNICATION]

For the guidance of the newspapers and periodical press, illustrative news syndicates, motion-picture producing companies, and independent photographers and artists generally, the following information concerning the making and distribution of pictures that show the activities of the Army and Navy during the period of the war is issued, in accordance with authority from the War and Navy Departments.

Permits to Make Photographs

Applications for permits to make pictures showing the activities of the Army, the Navy, and other departments and bureaus of the Government, if addressed to the Committee on Public Information, will be referred directly to the proper authorities, and unnecessary delays in securing proper consideration of such requests will be thereby avoided. It is the function of this Committee to secure access for the photographers whenever possible to the Government departments and to cooperate with them in making a pictorial record of the work that is being done. This task will be facilitated if all requests for permits are handled through one central authoritative office.

Special permits will be issued on occasions on condition that all photographs and drawings be submitted for approval to the Committee on Public Information, unless otherwise specified. Requests for permits should explain the character of the pictures desired and the uses for which they are intended, and should be accompanied by sufficient references to establish the character and responsibility of the person or organization from which the request comes.

Pictures Not Admissible

Pursuant to instructions emanating from the War Department and from the Navy Department, pictures of the following subjects should not be made or circulated without special permission in writing:

1. Army fortifications, magazines, wireless plants, navy yards, manufactories of munitions or any military equipment that has been installed or adopted since the outbreak of the war, as well as pictures that give information concerning ports of embarkation of of troops or the fixed land defenses of the United States or the number, nature, or position of their guns.

2. Close views of the details of construction, as well as of all tests, or new weapons, equipment, or instruments used by the Army or Navy, such as aëroplane devices, gun-handling gear, electric communications, stabilizers, submarine fixtures, sighting mechanisms, range-finding instruments, fire controls, turret interiors, new inventions and experiments of military or naval import.

3. Movements of troops marching or in transport in such a way as to identify localities, or pictures that reveal special duties of detachments, positions of guards or sentinels, or that show new military formations.

4. Locations of mine fields or the location, identity, or number of warships belonging to our own Navy or to the navy of any country at war with Germany.

5. Views, in either news or fiction films, that tend to misrepresent or to arouse prejudice against friendly nations.

6. Scenes abroad that have not been passed by censors of friendly nations.

Whether or not specifically prohibited by these rulings, when pictures are plainly of a character that require official consideration, representatives of motion-picture companies and distributing agencies, exhibitors, illustrative news bureaus, editors, and others are themselves expected to withhold publication. When there is doubt as to the admissibility of pictures, communication should be had immediately with the Committee on Public Information, which, with the least delay possible, will pass upon them.

Information not permissible in news matter should not be used in reading matter, titles, or captions in connection with photographs, motion pictures, or illustrations of the foregoing classes.

Exclusive Privileges and Releases

No exclusive privileges to make pictures for private commercial purposes will be granted to any photographer or artists.

Three prints from all photographic plates and films exposed with permission by other than the official photographers within territory controlled by the Army and Navy should be submitted for approval to the Committee on Public Information *before publication.* One print will be retained as a record by the department from which the permit is issued; one print will be retained by the Committee on Public Information; and the third print (if the picture is declared suitable for public distribution) will be returned to the owner, bearing the imprint, "Passed by the Committee on Public Information, Washington." The publication, sale, or other distribution of such pictures as are officially disapproved is forbidden.

Photographs made on permits issued by other departments and bureaus should be submitted for approval before publication. Still photographs should be submitted in duplicate; one print, if approved, will be stamped, "Passed by the Committee on Public Information, Washington," and will be returned to the owner; the duplicate print will be kept for the files.

One positive print of all motion-picture films taken by special permits should be delivered, free of charge, to the files of the department from which the permit to photograph is issued.

Official Photographs

All photographs made by official photographers are developed and printed by the military and naval authorities in accordance with the regulations that are provided. All official plates and films remain in the possession of the military and naval authorities, and are not permitted to pass into other hands. Prints of every official plate or film that is released will be kept on file by the Committee on Public Information for record; additional prints may be furnished by the Committee as may be required.

Official photographs of the Army and Navy will be released through the Committee on Public Information. All official photographs bear the imprint of the Committee on Public Information, Washington.

Prices

A uniform price of two ($2) dollars each is charged for the right to publish official photographs. This price includes one unmounted print for reproduction. Additional prints may be secured at a price that shall be determined, but which will approximate cost price plus a net charge of two (2) cents each.

No photographic or other copies for reproduction purposes may be made from official prints, and only those prints may be published that bear the official stamp of the Committee on Public Information. The purchaser of official photographs secures the pictures for his own use only or for the use of the organization which he represents, and he may not sell, loan, or otherwise dispose of the prints without the written permission of the Committee on Public Information.

Exclusive Rights

No exclusive rights shall be given to any person or organization to the use of any official still photographs.

Official Motion-Picture Films

Official Army and Navy motion-picture films will be released through the Committee on Public Information, and will be distributed as the demands of the occasion may warrant.

Official motion-picture films produced by other departments and bureaus may be secured at terms or under conditions that will be furnished upon application.

Photographers on Active Service

No photographers shall be permitted to accompany the Army abroad on active service in the war zones, except the official photographers in the Government service. Applications for permits for photographers and artists to picture the activities of the Navy should be addressed to the Committee on Public Information.

"Official Photographs" and "Official Photographers"

Only those photographs that are made by official photographers in the employ of or under contract to the Government may be termed "official photographs." Only photographers who are in the employ of the Government may be designated as "official photographers," and this designation will apply only during the period of their service.

Photographs Submitted for Approval

Motion-picture producers, illustrative news bureaus, and photographers generally are invited to avail themselves of the advice of the Committee on Public Information in regard to the admissibility of pictures that are taken without permits. In such cases photographic prints should be submitted in duplicate to the Committee on Public Information. If admissible one print will be marked, "Passed by the Committee on Public Information, Washington," and returned to the owner without further comment. If the picture is not admissible, the print will be marked, "Not authorized by the Committee on Public Information, Washington." The use of photographs thus disapproved is prohibited. The duplicate print will be retained as a record by the Committee on Public Information.

Motion-picture films will receive immediate consideration, and will be returned with the written approval of the Committee or with suggestions concerning changes that may be desirable.

No photographs or drawings shall be considered as approved until prints have been submitted for review and have been officially stamped or released in writing.

KENDALL BANNING,
Director of the Division of Pictures.

Committee on Public Information,
10 Jackson Place, Washington, D. C.
August 10, 1917.

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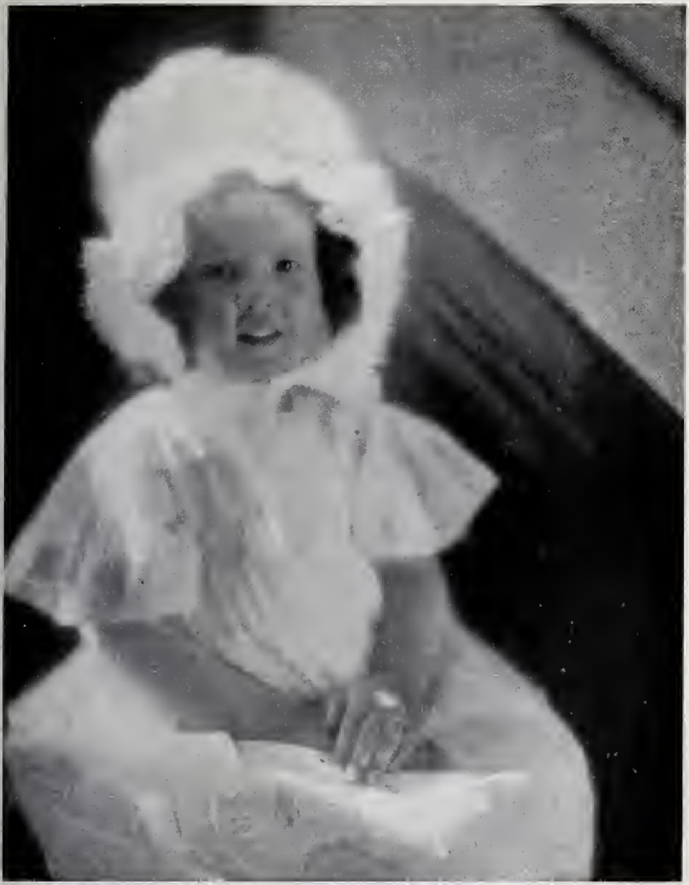

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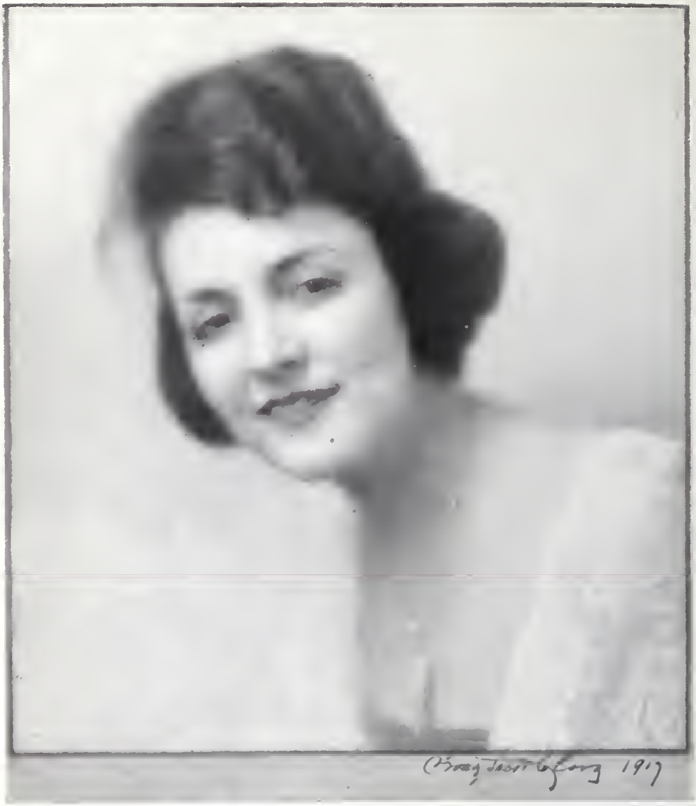

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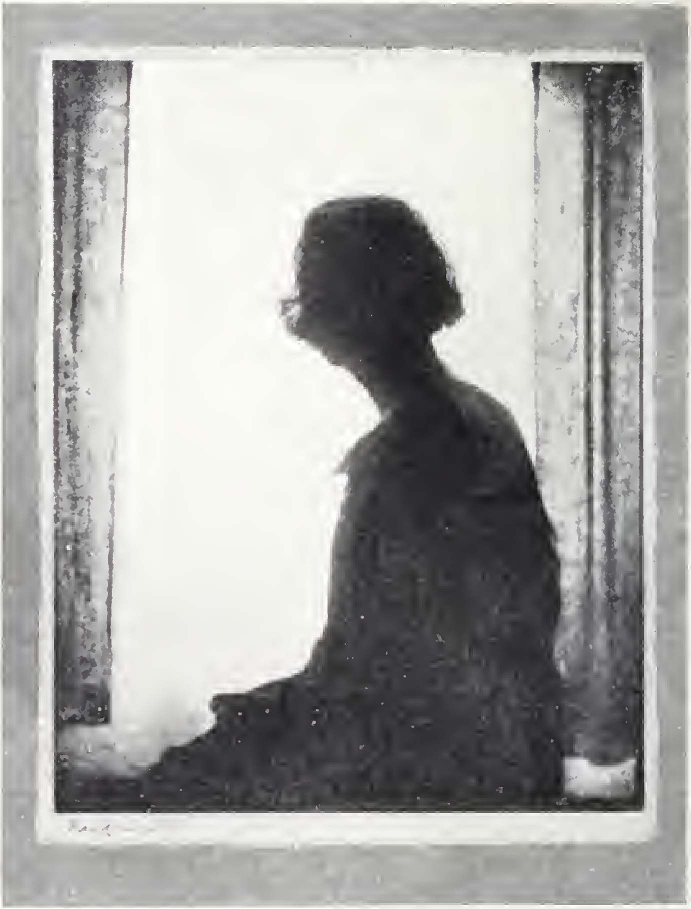

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Unconventional Portraiture

We are beginning to sense the charm of the unconventional in portraiture. One sees it more and more frequently, even in the most out-of-the-way places, such as the display cases of the fashionable studios on Fifth Avenue—the portrait which, while wholly pleasing in technique and artistic effect, arrests and holds our interest by a new note—its departure from tradition, its freedom from conventionality. Our appreciation of this unconventional portraiture is a practical appreciation. We willingly pay more for it than we grudgingly paid for the conventionalized portraiture of yesterday. It seems better worth while, and we give it a higher place in our regard. All of which is not to protest overmuch against convention, but merely to point out a modern tendency to disregard it altogether, which opens up new possibilities and has, in fact, given birth to a new school in photographic portraiture well worthy of our consideration.

The movement which gives us unconventional portraiture began with the coming of the amateur into photography—not the pioneers of the earliest years, but the modern amateur dating, let us say, from the splendid work of Mrs. Kasebier in the late nineties. Its evolution may be studied, most interestingly, in the salons and more important exhibitions of the past ten or fifteen years, and especially in the portraits made by members of The Photo Secession, published by Alfred Stieglitz in his "Camera Work." Latterly, this little leaven has leavened the whole body of serious workers

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in portraiture here and abroad, so that the cult of the unconventional in portraiture finds expression everywhere, even, as I have said, in the show cases of the professional studio.

Its Growth

It is true that, at first, the amateur fussed and sighed because his attempts at portraiture so little resembled the conventional product of the professional. But the wise old world, keenly mindful of the horrors of the family portrait album, quickly showed its preference for the amateur's portraits, finding them, in truth, more intimate in likeness, more interesting in their simple naturalness and more valuable as human documents than the portraits of the professional studio, by reason of their very lack of formalism and convention. Whereupon some of the more discerning among the amateurs saw the light and began forthwith to turn an honest penny by producing unconventional portraits—at an unconventional price. Seeing which undreamt of thing happen before his eyes, and beholding its steady growth in public favor, the professional portraitist is today divesting himself of his conventions—to his own profit and the world's gain.

An Idea—with Power

"Are you willing to learn?" This question was put, a few years ago, by a portraitist of international repute to a struggling photographer in a small Ohio town. "I am," was the prompt answer. Whereupon the successful one gave the struggling one a demonstration of an idea which has since forced the struggler into the front rank of American portraitists. The story is but another illustration of the potentiality of an idea, and I bring it in here because this little book about unconventional portraiture offers just such an idea. Translated into action, this idea has the power to transform your work in portraiture. If you are an amateur, it will bring you a larger measure of interest and joy in your work. If you are a professional, it will point out a new way by which you can reach out to bigger things and greater reward in your profession than you can hope to attain by following the traditional methods in which you have been trained.

Its Significance

Unconventional portraiture is just what the term implies—nothing more—and nothing less. The strength of its appeal and the potency of its charm lie in its simplicity and directness, its naturalness and consequent variety of effect, and most of all in its complete freedom from artificiality and convention. This last necessarily adds a note of originality, of freshness and surprise, which is altogether in its favor.

The Measure of Value

Its worth is measured by the single standard of fidelity in likeness—its completeness as a revelation of the personality of the subject—the essential and vital element in all portraiture worthy of the name. In place of the formalism, rigidity of pattern, and studied elaboration which have made the conventionalized portrait a byword, it gives us flexibility, animation, action, and vitality. But do not be misled by this apparent simplicity. It means thoroughly good portraiture, sound in technique and mastery of light and shade, plus the seeing eye and cultivated taste, working independently of and untrammeled by the traditions and conventions which have dominated and limited the achievement of photographic portraiture since photography began.

Difference of Viewpoint

It is in this elimination of convention and tradition that the professional worker will find his chief difficulty in attempting unconventional portraiture. He has so much to unlearn! The amateur, knowing nothing of studio methods, with their reliance on formula, make-up and properties, is free from these hampering limitations and can directly approach the subject from the single viewpoint of likeness. The difference between conventional and unconventional portraiture is a difference of point of view.

Learning to See

One begins in this school by learning to see—the cultivation of the eye. And this seeing must be concentrated on the character and personality of the subject. Observation, knowledge, understanding, tact, and sympathy must be our aids in this seeing. It is concerned with the psychological side of the subject and not at all with technical methods, these being presumed to function, so to speak, unconsciously. Preconception, the idea of fitting the subject into a pre-arranged scheme, or the adapting of a standard formula to the subject, is fatal in unconventional portraiture. Every different subject requires different treatment—there can be no classification or general scheme. To those who have learned to see —to look beyond the outward appearance—no two people are alike. Each has his or her own personality, largely made up of differences, the portrayal of which calls first for recognition and then for individual treatment. It is obvious that repetition of effect can have no place in an art which has to do with the representation of so elusive a thing as personality.

How Convention Masks Personality

One reason why the professional studio portrait has fallen into general disrepute and so often fails to satisfy, is found in this ruthless masking of personality by convention. It is, in fact, a falsifying of the record, and all too often results in a total suppression of the distinctive character and personality of the subject. Watch a professional of the conventional school at work in his studio, and you will see that he regards his sitters much as the tailor looks at his cloth—as material to be fashioned and made up in this or that style or mode. So, at the professional conventions, the portraits on exhibition are invariably suggestive or reminiscent of something or somebody other than the person photographed. In this you are reminded of a well-known portrait by a famous master in painting; in that you see a slavish following of the style and manner affected by a prominent photographer. Unconventional portraiture leads away from all this, takes no thought for style or uniformity of effect, but tries, simply and directly, to express the personality of the subject without artifice or convention.

What to Work For

Mrs. Kasebier used to horrify some of her sitters by the blunt remark: "My portrait of you may not please you or your friends, but it will embody the impression I get of you. All I can do is to photograph what I see in you." Pirie MacDonald says the same thing in other words, with a precious suggestion at the end: "While it is true that the value of the work of an individual lies in the way he sees the subject, at the same time one must be sure that his style is kept in a state of flexibility—so that he may show the difference between his subjects rather than their similarity. The way you see the personality is the point. . . . The basic trend . . . how he affects you rather than what he appears to the eye. . . . . Sympathy is the only road to this, and sympathy, as Lafcadio Hearn tells us, is limited by comprehension."

Individuality

This is well said. It leads me to make room here for a word or two about individuality in portraiture, of which we hear much these days. Do not confuse individuality and unconventionality. Both have to do with originality in expression, but they are things separate and apart. Naturally, the unconventional portrait will have individuality *plus* in its make-up. But it should be the individuality of the subject—not that of the photographer. This point deserves emphasis because the portraits of too many of our unconventionalists are a trifle persistent in advertising their makers. It is all very well for the portraitist to put his individuality into the making of the portrait—in the originality of his conception and expression of the subject; but it is plainly unpardonable to let this dominate his work. One should not be obliged, so to speak, to push aside the photographer in order to look at his work. This happens when we see even good portraits, where one's first unspoken thought is: Ah, this is a Duhrkoop. In portraiture the character or individuality of the subject should be the first and chief interest.

Simplicity

Again, it should not be forgotten that in a portrait the interest must be concentrated on the subject, not only by the elimination of all tricks of convention, but also by the practice of an almost severe simplicity—an avoidance of overmuch striving after the unconventional. After all, if unconventionality is carried to excess, we have as great a fault as that which was to be remedied. This is indulged where the portraitist makes some one element, such as draperies, clothes, etc., the salient feature of his work. Thus in a critique of this year's Salon (London) we are told that A's work is characterized by the note of "fantastic costume," and the critic aptly adds: "If one must be unconventional, it is much better to get the fresh note *out of* the sitter, rather than to dress him up in it."

A Practical Application

Speaking of another portrait in the same exhibition, the critic says: "It will be admitted to be a veritable triumph: The outlook is as new as anything here, and the style is fresh. The subject reclines in the garden, the head being backed up by a parasol, which throws a gentle shade upon the face. It is a half-length figure designed and fitted to the space of the paper with more sense of what designing should be than is usually found today among photographers who have ambitions toward freshness of treatment. This is a case where the likeness has every opportunity to be what it should be in order to please the sitter's friends. There is nothing which could offend the most sensitive mind on the score of reaching after the fantastic. At the same time, it is so far away from the ordinary studio portrait that the question arises in the mind whether it would not pay to secure facilities for work of this description in [connection with] some of our professional studios." I have supplied the words inserted within brackets in this quotation, as the writer obviously intended the work to be done out-of-doors and not in the studio itself.

In American Practice

The suggestion has been anticipated, as far as America is concerned, by a few professionals, among whom I may mention Mathilde Weil, Henry H. Pierce, and Walter Bachrach, as well as by many amateurs who have given serious attention to portraiture. Mr. Bachrach works, apparently, in the gardens or grounds of the country homes of his patrons. His single portraits and small groups made out-of-doors are among the happiest examples of unconventional portraiture I have seen.

I recall, too, a visit made some years ago to the country house of one of the Photo Secessionists. Portraiture, chiefly in the form of large heads, was his hobby, and his children and friends provided abundant subjects. His work was exceedingly interesting, not only because of its originality and fine technique, but chiefly because of the unusual lighting effects which gave it an indescribable charm. I questioned my host as to his studio. Without a word he led me out-of-doors and pointed to the many spots around the home, under the eaves of the house and about the garden, where he made his portraits. His prints offer indisputable proof, if proof were needed, that anyone possessing a fair knowledge of technique can surpass the conventionalized studio lightings without difficulty in this outdoor portraiture.

How the Idea Works

The basic idea in unconventional portraiture, viz. the forgetting or deliberate abandoning of all the traditions and conventions usually associated with photographic portraiture, gives the utmost freedom, not only as to the treatment of the subject, but also as to the location and circumstances surrounding the making of the portrait. Thus it is at once seen that any room, any window or doorway, and every part of a room or stairway, or garden, or business office may serve as a studio or place for the making of a portrait. Those professionals who have specialized in home portraiture have learned this, and willingly acknowledge that the most satisfying portraits are oftentimes made under conditions wholly opposed to those insisted upon in the professional studio. It is only when the photographer is unable to free himself from convention, and seeks to duplicate the familiar studio effects when working away from the studio, that he experiences difficulty and failure. It is difficult, at first, to realize that in abandoning studio methods and conventions, the art of portraiture is simplified and freed from the complexities which cause trouble under the professional skylight.

Concentration

So, in attempting unconventional portraiture, keep the simple, basic idea before you at all times. Do not confuse one thing with another. The single purpose in portraiture is to portray the character and personality of the subject. Everything else must be subordinated to this. Concentrate on this one thing—in your choice of location for the sitting, in your disposition and lighting of the subject, and in all else. Technique and method are but means by which you reach the end. Does the location help, by appropriateness or harmony, to induce a favorable mood in the subject, and so aid in the expression of his or her personality? Does the attitude, arrangement or disposition of the figure within the picture space, and the general scheme of figure and surroundings, carry out the impression you have formed of the personality of your subject? Does the light fall upon the subject in such a way as to bring out, emphasize or embody the most pleasing view of the sitter's personality? These are the questions of supreme importance in making a portrait.

Controlled by Law

Subconsciously, but none the less actively, the laws which govern all portraiture are applied as these bigger questions are being answered. These so-called laws concern the avoidance of incongruity, the control or emphasis or elimination of detail, the handling of the lines and masses in the composition, spacing, tone values, and the like. Unconventionality in portraiture does not mean any disregard of these things, but only the forgetting or abandonment of the artificiality and imitation which, in the guise of convention, have stiffened and formalized their use. This freedom calls out all the originality of the photographer, and offers the most complete opportunity for the exercise of his individuality and taste.

A New Viewpoint

I have said that, fidelity of likeness apart, the predominant note in unconventional portraiture is its freshness of viewpoint and style. This is the natural outgrowth of that infusion of originality which is made necessary by the abandonment of traditional methods and the old, worn conventions. Unconventional and conventional portraiture really differ only in this change of viewpoint. In the one we get the photographer's impression of the subject, directly and naturally expressed; in the other we have an interpretation, or perhaps I should say a translation, of the subject according to a rigid and inflexible formula.

Necessity of Originality

It is obvious that the unconventional portrait, if it is to be a thoroughly good portrait, cannot be a matter of chance, made in haphazard fashion without regard to the fundamentals or essential laws governing all portraiture. Hence, we must bring to our unconventional portraiture, not merely a freedom from convention, but also a thorough knowledge of the essentials of portraiture and a generous capacity for originality in the conception and treatment of the subject.

Its Meaning

Let us not misunderstand the meaning of this capacity for originality. As a general thing, we conceive originality as meaning some strikingly novel or daring quality, something "with a punch," so to speak. This is a false conception. It is simply the thinking or doing of something along new and different lines—a departure from familiar ways. In unconventional portraiture, it consists chiefly of the cultivation and exercise of common sense and good taste—the two qualities in the photographer which are atrophied by the continual following of formalized and rigid method. This exercise of originality is, in fact, so simple and natural a thing that one has difficulty in attempting to analyze its functioning, as if it were something to be acquired from outside oneself. It is being ourselves and expressing ourselves in our work.

How it Gives Variety

From this viewpoint the photographer approaches his subject directly, with the single purpose of expressing in the portrait the impression made upon him by the subject—by what he sees in the subject. This concentration gives comprehension, the key to that sympathetic appreciation of the sitter's personality—which ensures freshness and variety of effect in the portrait, since differences in character and personality necessarily produce difference and variety of impression. As a natural result, the sameness and monotony which are the bane of the conventional portrait no longer mask the subject's personality. Attracted, at first, by a certain novelty or freshness of effect, we find ourselves absorbed by the revelation of personality in the portrait. This is as it should be. In actual practice this freedom from convention and this exercise of originality come into play from the first meeting with the sitter, and influence and direct every movement in the making of the portrait.

A Word from Rodin There is a paragraph in Lawton's "Life of Rodin" in which the great sculptor gives us his view of this matter. He is quoted as saying: "I should like to call myself a Naturalist, but that word is so much misused. . . . Nature has been my great teacher. Everything can be obtained if Nature is followed. . . . So many dictate to Nature; if they have a man or woman model before them they impose a preconceived attitude with no relation to the mind or character of the subject. Today, toward the end of my career, I content myself with leaving my model to himself or herself. I dictate no poses. At most, I venture to prolong them, when I have found what I seek. Any dictated attitude is for the nonce unnatural; the body loses its charm and becomes absurd and ridiculous. . . . I reproduce only what I see in the model, and what anybody else could see if they would take the trouble; but then I am always looking."

Its Application There is here the germ of that originality which is needed in unconventional portraiture, the capacity for seeing and its exercise without the limitations of convention. Apply this freedom from preconception regarding pose and attitude to the insistence on detail and precision of form which marks the conventionalized portrait, and you perceive how the lack of it in unconventional portraiture is justified.

Likeness and Detail That likeness does not depend upon detail may be proved by our instant recognition of any one of our friends, even across the street, where scarcely a feature can be defined. Likeness will be found to lie more in general form and the masses of dark and half-tints; and the eye, taking in the form at a glance, assists the imagination in completing the resemblance. This is one great reason why the portraitist should be careful not to lose the peculiarities of outward form, either in the head or the contour of the figure of the subject. The extreme darks, and their exact distance from each other, are greatly conducive to likeness, as is also the marking of the points where the highlights fall, particularly on the forehead, nose, and cheek-bone. By the presentation of too much detail, or its emphasis, the breadth is destroyed and the portrait loses the lifelike and moving character of Nature. In the pictures of Rubens, where the lines and forms flow into each other, being merged broadly instead of closely defined, these qualities are very evident.

Expression

It is important to recognize the power of expression to give animation and agreeable character in portraiture, whether it be qualified by manly dignity, childlike grace, or womanly gentleness. Without expression, the features, although correctly rendered, will be found lifeless and fixed. This, the charm of all true portraiture, comes more easily and naturally when the subject is not confused and fatigued by the photographer's attempt to impose his conventions and modes upon his sitter. In women, the seat of character is in the outer corners of the eyes, especially the lower eyelid, and the corners of the mouth. These points the portraitist should watch during the sitting. Dignity lies in the under-lip and chin, the upper orbit of the eye and forehead; to give the former without a simper, and the latter without a frown, requires the nicest feeling of the artist.

The great qualities of portraiture are found in the pictures of Titian. To every material object, hard or soft, rough or smooth, bright or opaque, obscure or transparent, his pencil imparted its true character and appearance to the eye, with all the force and harmony of light, shade, middle-tint, and reflection, by which he perfectly relieved, rounded, and connected the whole. Here is the ideal to which the portraitist should aspire in his technique. You can study it in the portraits by Velasquez and Van Dyck.

Drawing Form The drawing of the figure is also a point of importance in portraiture. Michael Angelo said of Titian that had he been a correct designer he would have been the master-painter of the ages. Titian, like his contemporaries, began his career by merely copying Nature as she happened to present herself, without choice or selection, and labored for some time in the labyrinth of littleness; but a hint from Giorgione soon taught him that taste was as requisite as industry; that labor might be misapplied, and truth itself become uninteresting and unnatural; that the detail must be sunk in the essential and predominant characteristics of the subject; and that the art of portraiture consists, not in presenting a feeble catalogue of particulars, but in securing a characteristic, comprehensive, and animated impression of the subject. This extract certainly contains the true philosophy of portraiture, and should be constantly kept in mind. It is indispensable that the photographer should train himself in the sympathetic comprehension of character, in order to see what to portray and what not to portray in his subject.

Referring to the portraiture common in his day as it is in ours, Fuseli remarks: "It is the remembrancer of insignificance; mere human resemblance in attitude without action, features without meaning, dress without drapery, and situation without propriety. The aim of the conventional portraitist is confined to the *external* likeness, the deeper, nobler aim, the personification of character, being forgotten or neglected in a slavish following of professional convention.

Essentials This insistence upon directness and naturalness in the representation of the subject, the securing of likeness and variety of effect in the portrayal of personality, the suppression of irritating and distracting detail in form and definition, and carefulness as to correct drawing, are among the essentials of portraiture which must not be overlooked or neglected, however pronounced be the departure from conventional modes of treament. The charm of the unconventional portrait lies, not in eccentricity, nor in the disregard of the generally accepted principles of pictorial representation, but in fidelity of likeness combined with freshness of viewpoint. The unconventional portrait, in other words, must always be a satisfying and thoroughly sane bit of work, with the added charm of naturalness and intimacy resulting from a deliberate forgetting of old-time conventions.

The Conventions

These conventions, as we know, center in the professional studio and its artificial methods. Hence, the first step in unconventional portraiture is to cut oneself loose from these things. This means, primarily, the study and observation of personality wherever we find it, with a view to its representation by means of photography—just as we see it expressed in the everyday life around us. As one result of this free observation and study, we will quickly realize that the formal professional studio (or its makeshift equivalent in the home) is not at all essential to good portraiture; that formalized lightings and poses or arrangements peculiar to the studio are vastly less interesting than the natural arrangements and lightings seen in the home or out-of-doors; and especially will it be made plain that, by photographing our subjects in their natural environment we can secure likeness and variety of effects in a measure not possible to those who work under the hampering limitations of the studio.

The Cultivation of the Eye

It is in this first-hand study of personality, as expressed in everyday life and action, that the portraitist must seek the inspiration necessary for his work. All that he can command of sympathetic observation and lively imagination, combined with concentration of interest, must go into this learning to see—the cultivation of the eye. In this learning to see, the beginner in unconventional portraiture will find much encouragement and many valuable suggestions in the published work of others in this field. But the cultivation of the eye and the development of comprehension must be the one thing aimed at in this study, and not the unconscious accumulation of models and types for imitation. Look at the other man's work simply to see what he saw in his subject, and how he expressed what he saw in his treatment of the subject.

Illustrations The illustrations preceding this monograph may serve as examples for such a study. In every one we have likeness—the portrayal of the personality of the subject—as the supreme interest; in every one we see a radical departure from one or another of the conventions. Contrast, for a moment, the two groups by Strauss with the conventional portrait group as it is usually done. Compare, again, the outdoor portraits of children by Hutchinson and Weston with the stereotyped studio portraits of children posed against the usual painted background. Then turn to the daring but effective disregard of conventional modes of lighting seen in Clark's portrait of Commodore Steffens and Hutchinson's delightful sun-flecked portrait of a little girl. Note how charmingly Roger Whitman has given us a child with her doll, in sheer defiance of the convention which forbids the introduction of strongly marked parallel lines and forms impinging on the figure. And see how instinct with character and personality is the portrait of a young girl by Maud Langtree, despite its ruthless overturning of the tradition that one must always show some part of the face and eyes of the subject in a portrait. So much for superficial observation. I have purposely chosen somewhat extreme examples to emphasize the difference of viewpoint in unconventional and conventional work.

What to See The big fact to grasp here is that the chief interest everywhere is the portrait *per se*. The other facts, such as the individuality of the photographer, the freshness of the point of view and the manner of treatment of the subject add to the interest, but are so controlled as to emphasize rather than detract from the element of likeness. Go over them again, and you will see how, in each one, the personality of the subject is the chief and abiding interest.

Other Men's Work For a further study in unconventional portraiture I may profitably refer the reader to *Camera Work*, in which many fine examples of modern schools may be seen; to Cazmeaux's "The Japanese Blind;" Lambert's "Undine;" Miss Williamina Parrish's "Sacha;" Miss Partridge's "Designer and Design"—all in "Photograms of the Year," 1916; to Miss Vandamm's "Elsie;" House's "Sunny Group"—in "Photograms of the Year," 1915; to the superbly clever "Portrait" by Marcus Adams and Garo's "Portrait of a Gentleman" in "Photograms of the Year," 1914.

In *The Photographic Journal of America* (October, 1915), a few examples of Walter Bachrach's outdoor portraiture may be seen; there are several good examples from the Pittsburgh Salon of 1916 in the May, 1916, issue of the same magazine, including Mrs. W. H. Rau's delightful "Sweet Sixteen." Mr. C. Crowther's virile portraits of men may be studied in the October, 1917, number.

A Word from Duhrkoop

As a practical illustration of the working out of unconventional portraiture, I cannot do better than quote from a recital of his methods given by Dührkoop, when he visited this country a few years ago. Speaking of "at-home" portraiture he says:

"At-home" Portraiture

"In private residences it is sometimes difficult to find a quiet wall which permits the production of a good portrait. For this purpose we always make use of a piece of cloth that we take with us, mostly of an orange colour, for a background. The capability of quickly discovering the suitable light for a sitting is a matter of experience and constant practice. Certain it is that ladies and children particularly show themselves much more at their ease in their own rooms, and that in consequence original pictures are easily possible. If you photograph children in their playroom, at their dinner table, in the garden, you get the most charming pictures. Women in the home offer the most delightful possibilities for the use of different articles and costumes, and thus in boudoirs, and in the frequently beautiful rooms of private houses, photographs are made that are wholly free from all the conventionality that the studios in the daily rush of business cannot help producing. Of course, people often wish to have portraits taken in places where there is no light for it; then flashlight or electric light, if to be had, must be used. Flashlight is altogether an excellent thing, which I am fond of using, particularly for difficult groups and children. With it you get instantaneous exposures that could not be obtained by any other means. The disadvantage of private rooms (that is, the insufficient lighting) of course forms a great difficulty. This must be helped out by supplementary lighting sources and reflectors. It can generally be calculated that a reflecting cloth reflects about a quarter of the light, and that will suffice in most cases to light the shadows up well. The conquest of these difficulties gradually becomes as easy for the skilled operator as the setting of the picture in the equal light of the studio produced by the drawing of curtains. But it is a delight and a great satisfaction to be able to produce pleasing portraits under such difficulties.

Out-of-Doors

"If you are once accustomed to go into private residences, you will then also gladly avail yourselves of the gardens and parks for photographic purposes. And how wonderfully fresh and animated can ladies, children, and groups be reproduced if you are accustomed to finding the right light in the open air, which is not difficult. There are wonderful opportunities out-of-doors. Of course, you must not look for the accustomed lights of the studio, but also test and study all other possibilities of light. Taking photographs is possible in every light that our rooms or the open air afford, and if you have once occupied yourself deeply with portraits in 'the open,' you will feel great delight in the numerous and picturesque possibilities offered to your creative feeling.

"If you wish to take a sitting in 'the open' the subject must be placed so that it is near the wall of a house or a group of trees or such like to obtain some shade, while the other side is exposed to the sharp light. If you lead the model to and fro under the trees the trained eye will easily find a place where the light is so constituted as to make a good exposure possible, and where light and shade suitably alternate. Of course, you must endeavour to choose a background not crossed by too many spots and lines and made too restless. Perfect smoothness and rest, however, are equally unnecessary, and we must observe how painters treat such things. Nor is it necessary that the portraits show the usual change of light and shade. On the contrary, it is highly important to operate with lights such as modern painters love, thus also with front light, which produces less plastic but more surface pictures, i.e. flatter lightings.

"Compared with the frequently stereotyped uniformity of the studio light, the great diversity of open air and interior exposures, with their continually varying scenery, is immensely more interesting, and every thinking photographer ought to endeavour to master and develop this side of photography and to turn this delightful diversity to account in his work.

How Duhrkoop Works

"How do I take my sittings? I do not go to work with any preconceived notions, but offer the subject a chair, beg him to make himself comfortable, and meanwhile begin a conversation adapted to the character of the sitter, concerning his wishes, etc. During this I study him and try to find an arrangement which will best display his personality and character, always seeking an unconstrained position and surroundings, and to avoid everything formal or obtrusive.

"The portrait of a man is generally looked upon in photography as a gratifying and easy task compared with those of children, ladies, and groups, the conditions for success being here simpler and more favourable. The woman's portrait has, to all appearance, richer variations; clothing, ornaments, and accessories can afford more multifarious forms and motives, but require a peculiar psychological gift.

"The man's portrait is more limited and decisive—the simpler, the better it is. It is difficult (nay, in many cases impossible) to influence a man's expression and mentality. The photographer will be able to do little to influence a man of work, a scientist, a soldier, to approach his own conception, to get him to sit or stand differently from what he is accustomed to do.

He will have to lay more stress on the lighting so as to let the head be thrown into more relief; he will choose the lighter background if he wishes the contours of the figure to say something; he will suppress all petty accessories, will try to subdue too violent high-lights, for instance, here and there, the linen, etc., but will do nothing to obtain a particular conception, gesture, or picturesque arrangement.

"Nevertheless, if the photographer finds himself bound within seemingly narrow limits here, on the other hand he runs less risk of producing work which does not please or is unsuccessful, as often happens with women's, girls,' or children's portraits. The problem of similarity, for instance, which otherwise gives rise to disagreeable discussions and misunderstandings, will cause less trouble in men's portraits. A more pronounced formation of the skull, more definite features, are of great assistance to the photographer, who can heighten their effect by the intelligent management and variation of the light.

"Too great an insistence on the pose always seems to me an infringement on the rights of the subject, who ought to have his own position and not that which another man wants him to have and which is not natural to him. An individual must remain an individual if personality is to be expressed."

Greater Freedom

In this account of the methods followed by Dührkoop, it is necessary to keep in mind that the value of his teaching is purely suggestive, and that in the few years which have elapsed since he was among us, unconventional portraiture has made distinct progress. This progress has been in the direction of a larger freedom in the treatment of the subject than that indicated in the extract from his address. This is seen in what follows in the "Notes" sent me by Edward H. Weston, a Californian worker whose unconventional portraits are widely known and admired. He writes:

Weston's Methods

"I work in a room in which the light comes from three directions: from two French doors and one long, low, horizontal window—all of clear glass. Most of the day the sun shines through one or more of these sources of light. No curtains are on the windows, nor diffusing screens, nor reflectors in the room, nor any method of controlling the light other than a nitrogen-lamp which is occasionally used as a supplementary light.

"All backgrounds have been discarded except those for special decorative effects, which are brought out when needed. In fact, the usual 'necessary' accessories are nearly always unnecessary.

"I have a room full of corners—bright corners, dark corners, alcoves! An endless change takes place daily as the sun shifts from one window to another.

"But stop now! All those harnessed to the bugbear of a diffused, 45 degrees north light!' Tradition enervates you; read no further! Dare you to walk alone, and unafraid, of criticism or your pocketbook?

"Now for the big secret of success, not monetary of course—that is a miserable kind of advancement.

"As great a picture can be made as one's own mental capacity—no greater. Art cannot be taught; it must be self-inspiration, though the imagination may be fired and the ambition and work directed by the advice and example of others.

"To be sure, draughtsmanship can be taught, but that is an empty nothing without creative talent inborn. Why this apropos of photography? Because the portrait photographer of the future must be an artist; if not a genius, at least talented.

"How now! Do you doubt my trend of reasoning? Think you to buy a semi-achromatic lens and in so doing become an artist? Amongst abominations a picture made by the tyro with a soft-focus lens ranks high. Better by far an honest, clean-cut, record photograph than a nondescript abortion.

"Record photography has become so simple an affair that a child can kodak and even learn to finish well. So how easy it is to imagine one can add the individual touch by purchasing a lens supposed to do the work, or by using printing paper warranted to produce an artistic result. No, no, the picture must be a product of one's intellect, not the result of using this lens or that paper or somebody's plate.

"What have I to offer then?

"My plate and paper formulæ are practically those offered by the manufacturers; my lens and camera, those of a thousand others. My plates are usually tanked. Any individuality in my work is entirely due to the selection, arrangement, and lighting of the subject—the picture is conceived in the mind, not by the camera or plates or chemicals.

"I should rather have it said of my work that it showed individuality than that it showed perfect composition or wonderful technique, if the latter work also combined dreary mediocrity of interest. After all, I have no *objection* to composition if it does not dominate, nor to technique if it does not turn one into a draughtsman!

"Now to be seemingly contradictory—I abhor poor technique and weak compositions! My case against them has been made strong for emphasis.

"Finally, to increase one's art appreciation, literature, music, the drama, and other arts are as important as the study of pictures, perhaps more so, for the former would not tend to influence one into merely copying other work."

Finis

With which bold word this little book may fitly end. If by text and illustration you have grasped the idea it aims to set forth before you, your labor, and mine, will have been well repaid.

An Appreciation of Capt. A. Radclyffe Dugmore

One of the most interesting figures among the war lecturers who will visit America this year, is Captain A. Radclyffe Dugmore of the King's Own Yorkshire Light Infantry, well known as a painter and photographer of big game, and a man loved by all who know him. Few men have been more successful in the United States as a lecturer than Captain Dugmore, and it is rare that one has the opportunity to hear a man who has had both experience in action and in the lecture field. Those who heard Captain Dugmore deliver his famous lecture, "Stalking Africa's Big Game with a Camera," will remember his rare ability as an entertainer and will know that the same nerve which enabled him to photograph a charging rhino would enable him to face readily a charging German.

It is not merely of his own experience that he will tell. With the approval of the British Foreign Office, he comes to tell of the war, the reasons why England is fighting, and why we are now by her side. He tells of many things that have not come to our notice. But his experiences form an excellent background on which to work, and it is around his own story that he weaves his lecture.

On August 14, 1914, just after the outbreak of the war, Captain Dugmore, then a civilian, crossed over to Belgium to see for himself what the conditions were and also to try to secure some photographs of modern warfare. His photo-hunting tendencies soon got him into no end of trouble, and he was arrested as a suspected spy, first by his own countrymen, the British, then by the Belgians, and finally he was captured by the Germans. He succeeded in escaping, but later, at

Alost, where he was trying to photograph a fight between German and Belgian forces, his good luck partly deserted him and a big shell, exploding nearby, so badly wounded him that it was the following December before he was able to be about again. Although much over the military age, he was anxious to join his countrymen in the war, and as soon as he was able, he enlisted in the Inns of Court Officers Training Corps and later obtained a commission as lieutenant in the 10th Battalion of the King's Own Yorkshire Light Infantry.

In March, 1916, he went to France and he commanded a company until the middle of May. Then he was appointed Brigade Scout and Intelligence Officer and began on that very interesting work of finding out what the enemy was doing. His stories of this episode in his life at the front are both amusing and exciting. All methods were adopted to keep posted with what "Fritz" was doing, and his movements were communicated to the men as much as possible for their own good. In preparing for one offensive, an entire duplicate set of the German trenches was made back of the British lines and the British soldiers so thoroughly trained in attacking them that they knew every corner and turn by heart. But when the big attack came, it was of little avail, as the extensive British gun fire had made the German trenches an unrecognizable sea of mud and shell craters.

It was in the great battle of the Somme, where the tanks first went into action, that Captain Dugmore came to grief. In this offensive the Germans introduced a new poison gas, some of which Captain Dugmore was unfortunate enough to inhale, with the result that he was disabled for all further active service, and now that he has recovered sufficiently for his present mission, he has come to tell us in America of the details of the great war. With his experience as a lecturer there is perhaps no better man. He is able to tell us who are now about to go into the war, what we must expect, and what we must prepare for; and is able to tell it as only a man who has been through it all can.

The matter of military preparedness is one that the military authorities must deal with, but there are kinds of preparedness to which the civilian must attend. He must be prepared to go at his country's call first of all, and once he has gone, his friends must look after his needs in the many things that are apt to be overlooked. There is the tobacco fund to be kept going, there is the work of the Y. M. C. A. and there is the work of the Red Cross. These are all helped by those who stay at home. And those who stay at home can most willingly bear the financial burden of the war when the needs of the guns at the front and of the armies that are with them are described. Few of us realize that thousands of miles of railway were laid down before the battle of the Somme was possible, few of us realize that the guns on the offensive front were placed about five or six yards apart. The whole thing is too vast for us to grasp at a distance, and it takes a man like Captain Dugmore to explain it all to us. His lecture, "Fighting It Out," is a soldier's story of our fight for freedom. If he comes to your town go and hear his story. You will enjoy its graphic realism as he tells it, and the wonderful pictures with which he illustrates his adventures.

Books and Prints

Camera Work. Mr. Alfred Stieglitz writes me that "Camera Work" has not been discontinued but, as during the past few years, will appear as occasion warrants. He adds that as a quarterly it ceased to exist some years ago. The most recent issue published, numbered 48-50, is devoted to the work of Paul Strand. Price, $10 per copy. Complete sets of "Camera Work" are exceedingly rare and very valuable. I recall sales a few years ago at from $200 to $300 per set.

Finishing Prints in Black and White and Colors: The Essentials of Retouching. By George H. Croughton. 66 pages, octavo, with illustrations. Cloth, $1.50, postfree.

The photographer seeking practical instruction in the two branches of professional work dealt with in this book could not wish for a better or more competent instructor than Mr. Croughton, who has spent a fairly long life in the practice of the methods he here explains. The directions given are fully detailed and thoroughly cover the subject with working methods. It is abundantly illustrated.

Collodion: and the making of wet plate negatives for photo engraving work. 24 pages. Eastman Kodak Company. Rochester, N. Y. No price.

This is the latest of the new series of brochures published by the Eastman Kodak Company to familiarize the practical worker with the proper use of Eastman products. It is a handbook of information concerning the use of Eastman collodion in photo-engraving, prepared by Mr. A. J. Newton, and embodies the experience of his coworkers in the Engraving Department of the E. K. Co. since its inception two years ago. Although primarily intended for photo-engravers, the handbook will prove invaluable to all who use the wet collodion process for any branch of negative making, offering, as it does, actual working formulas and methods proved by daily experience. At the end of the handbook the reader's attention is called to the fact that the Eastman Engraving Department is maintained, not only for the purpose of producing illustration blocks of all kinds for the E. K. Co., but also as a Service for the advising and helping of all photo-engravers who encounter technical difficulties in their work, whether they are users of Eastman products or otherwise. This offer should not be overlooked and forgotten.

PICTORIAL PHOTOGRAPHY: Its Principles and Practice. By Paul L. Anderson. 302 pages; 23 illustrations. Philadelphia: J. B. Lippincott Co. Cloth, $2.50.

As a worker's handbook to the use of the apparatus and technical processes discussed in its pages, this book will probably give greater satisfaction than any similar work at present available. Its information is clear, direct and positive in character, being, in fact, drawn largely from the personal experience of the author with the tools and methods described. But it is bound to disappoint those who, misled by the title, expect to find in its pages a guide to the principles and practice of pictorial photography, as this descriptive phrase is commonly understood and used, since a perfect knowledge and practice of the whole contents of the book will not bring the reader one whit nearer the production of photographs possessing pictorial quality than he was at the start.

The title is, to say the least, unfortunate and can lead only to confusion and disappointment. The principles and practice of pictorial photography are in no sense based upon the use of, or the particular method of using, special sorts of apparatus or manipulative methods. And no one is more clearly conscious than Mr. Anderson of the plain fact that the use of this or that lens, or plate, or paper has no influence worth mentioning on the production of pictorial quality in a photograph made with any combination of them. His belief as to this is plainly expressed in the concluding chapter of the book, where he states that the photographer cannot become a pictorialist merely through familiarity with technical methods. And yet, as the following abstract of its contents shows, the book confines itself to the discussion of apparatus and technical methods, and the reader is referred to other, outside, sources for the knowledge of "composition of line and value" and the cultivation of the "spirit," which is vaguely defined as "the expressive impulse underlying the choice of subject and the manner of its treatment"—both of which are acknowledged to be equally essential with technique in the making of the pictorial photograph.

Contents. Chapter I. The Camera. II. The Lens. III. The Plate. IV. Exposure and Development. V. Miscellaneous Apparatus. VI. Manipulation of Negatives. VII. Enlarging. VIII. The Ideal Medium. IX. Discussion of Various Mediums. X. Technique of Platinum. XI. Technique of Carbon. XII. Technique of Gum. XIII. Technique of Gum-Platinum. XIV. Technique of Oil and Bromoil and of Transferring. XV. Technique of Photogravure. XVI. Desirability of Color in Photography. XVII. Technique of Color Photography. XVIII. Photography by Artificial Light. XIX. Motion Picture Photography. XX. Conclusion.

Abridged Scientific Publications from the Research Laboratory of the Eastman Kodak Company, Rochester, N. Y. Volume II. 1915-1916. 134 pages. No price given.

This is the second series of abridgements issued by Dr. C. E. Kenneth Mees and his associates of the Eastman Research Laboratory. It is intended for reference use by advanced workers in photography, to whom its contents are, undoubtedly, of great interest and value. From this viewpoint the Eastman Kodak Company deserves the thanks of all students for its publication of these abridgements. A synopsis of the Contents Table clearly shows the general character of the abridgements, as follows:

X-Ray Sensitometry (Tugman); The Accurate Determination of Silver by Electrolytic Deposition from Cyanide Solutions (McDaniels and Schneider); The Kodachrome Process of Color Portraiture (Mees); The Optical Properties of Diffusing Media (Nutting); The Optical Properties of Photographic Papers (Nutting); Projection and Focusing Screens (Nutting); An Adaptation of the Koch Registering Microphotometer to the Measurement of the Sharpness of Photographic Images (Tugman); The Resolving Power of Photographic Plates (Tugman); The Retinal Senibilities Related to Illuminating Engineering (Nutting); Relative Photographic and Visual Efficiencies (Jones, Hodgson and Huse); Artificial Illuminants for Use in Practical Photography (Mees); Some Quantitative Data on Cathode Deposited Metals (Nutting); The Stripping of Gelatine Dry Plates (Furnald); A Ratiometer for Use in Color Reproduction Work (Newton and Furnald); The Photographic Production of a Lithographic Key on Zinc (Crabtree and Newton); A Precision Shutter Testing Instrument (Nutting); Effects of Brightness and Contrast in Vision (Nutting); Proportional Reducers (Huse and Nietz); The Measurement of the Absolute Viscosity of Very Viscous Media (Sheppard); Optical Properties of Light Filters (Mees); A Compensating Filter in Spectroscopy (Hodgson and Wilsey); The Nature and Speed of Flash Powders (Crabtree); Fundamental Scale of Pure Hue and Retinal Sensibility to Hue Differences (Jones); The Mordanting Action of Metallic Ferri—and Ferrocyanides (Clark); Stellar Images of a Photographic Plate as Affected by Development (Ross).

The approach of the flashlight season brings to any table a few booklets dealing with flashlight apparatus, supplies and methods of which the reader should be informed.

"By Flashlight" is a 16-page instruction book for amateurs, giving methods, diagrams and illustrations of practical help in the making of portraits and groups at home, with the Eastman Flash Sheets and Cartridges. It is published by the Eastman Kodak Company, Rochester, N. Y. and can be had on request from any Kodak dealer.

"The Prosch Flashlight System" is a 38-page catalogue and instruction book combined, describing the Prosch flashlight equipments for amateur, professional and commerical photographers and telling how to use them. This system is undoubtedly the most methodical and comprehensive scheme for flashlight work of all kinds thus far offered in America, and covers every phase of photographic work where the flashlight offers practical advantages. The booklet, by its detailed descriptions arranged in logical sequence, its fullness and its capital index, is a valuable reference which every photographer should have at hand. A copy can be had, without charge, by writing to the Prosch Mfg. Co., 334 Fifth Avenue, New York City, mentioning this note as the source of your desire for information.

"Flashlight Specialties" is a 24-page booklet *de luxe*, describing and illustrating the flashlight specialties of James H. Smith & Sons Co., 3541 Cottage Grove Ave., Chicago. Its halftone illustrations offer convincing proof of the practical efficiency of the specialties described. You can obtain a copy by postal card request, mentioning THE PHOTO-MINIATURE.

HOW TO MAKE PORTRAITS, Practical Photography. Series No. 6. 62 pages diagrams. Paper covers, 25 cents; clothbound, 50 cents.

So far as my knowledge goes, this is the most useful guide to amateur portraiture at home available today. It is practical in its instruction and clearly explains the principles of lighting, placing the sitter, etc., as applicable to the confined situations found in the rooms of an ordinary home. The beginning amateur could not desire a better handbook to this field.

The 1918 Catalogue of the David Stern Company, 1029 Madison St., Chicago, sent free on request, is a 100-page illustrated list of photographic apparatus and supplies, providing a comprehensive index to the tools and conveniences of today well worth sending for.

AMERICAN WORK AT THE LONDON SALON 1917. In the *Amateur Photographer* of October 8, Mr. Anthony Guest reviews the work of the American exhibitors at this year's Salon in detail. As prefacing his review, Mr. Guest says:

"A welcome of more than ordinary cordiality is due to the American contribution to the present Salon show, not only on account of the special circumstances of the time, for the work has qualities that commend it independently of all other considerations. It might be a good plan to indicate the nationality of the prints on their frames, but every visitor who has the curiosity to search the catalogue must recognize how far the American examples go to enrich the gallery with fresh evidences of a zealous and progressive spirit and a lively perception of the inner poetry as well as the outward appearances of nature.

"To me the American work this year conveys a fuller sense of sincerity than previously, and a nearer approach to the realisation of imaginative conception. The personal motive finds less riotous but far more truthful and effective expression, because it accepts the guidance of natural beauty in the spirit of faith allied to humility that must be the possession of every genuine artist. It is when we see this guidance thrown over by hideous distortions made in Germany (where the cubists and other eccentrics no doubt represent the debased national genius) that the reverse side of the picture is revealed. That admirable examples come from widely separated corners of the States is a sign of the spreading progress that is going on.

"What is the direction of this advancing movement? This is a question of no slight importance, and I think that those who bring enlightened discernment to bear on the work will find the satisfactory answer that the advance has the right tendency, for it is towards depicting the idea, while not neglecting the material facts, but keeping them in due subjection. . . .

"Originality is a marked characteristic of Mr. E. H. Weston's portrait of 'Miss Dextra Baldwin,' a clever design with the figure in shade, and a decorative effect of sunflecks in repeated lines; and an original idea is to be noted again in 'Under the Boardwalk, Atlantic City,' by Mr. W. G. Fitz. who has found his opportunity in one of those generally unregarded effects, for which a keen vision should be on the alert, the rows of light on the backs of empty seats in a concert room. . . .

"Freshness and invention are to be credited to Alice Boughton in the portrait 'Edith,' with the light on the back of the chequered collar, an unconventional arrangement giving a pleasant result.

"An attractive composition also is 'Roses,' by Louise Bell Rau, the girl being depicted with an expressive face that testifies to her pleasure in the flowers. 'Mlle. P.,' by Mr. J. T. Banfield, is a quiet portrait of picturesque design.

"Mention should also be made of 'The End of the Dance,' in which Mr. F. R. Archer shows a half-draped dancer bowing to the earth with the light playing prettily on the ornamental pattern of her scanty garment."

Notes and Comment

SIGNAL CORPS APPEALS FOR LENSES FOR AIRCRAFT CAMERAS. The Chief Signal Officer of the U. S. A. requests that the widest publicity possible be given the following appeal:

People of the United States are asked to help the Signal Corps of the Army get lenses enough for cameras for the fleet of observation airplanes now being built. The need is immediate and of great importance; the airplanes are the eyes of the Army, and the camera lenses are the pupils of those eyes.

German lenses can no longer be bought in the open market. England met this difficulty in the earlier stages of the war by requiring lens-owners to register lenses and requisitioning those needed. The Bureau of Standards of the United States Department of Commerce is now perfecting a substitute for the German "crown barium" glass used for lenses and will later be able to meet the needs, and special lenses are being designed for this work.

The situation now, however, is that, with airplanes soon to be ready for service, suitable lenses cannot be bought. Hundreds are needed at once. Possessors of the required types are urged to enlist their lenses in the Army. They are asked immediately to notify the photographic division of the Signal Corps, United States Army, Mills Building Annex, Washington, D. C., of lenses of the following descriptions which they are willing to sell, stating price asked:

Tessar anastigmat lenses, made by Carl Zeiss Jena, of a working aperture of *f*3.5 or *f*4.5, from 8¼ to 20 inches focal length.

Bausch & Lomb-Zeiss Tessars, *f*4.5, from 8¼ to 20 inches focal length.

Voigtlander Heliar anastigmat lenses, *f*4.5, 8¼ to 24 inches focal length.

The 8¼-inch lenses are urgently needed; also 12-inch condensing lenses.

Penrose Process Year Book. We are advised that, owing to the difficulties of production in war time, the English publishers of this well-known process workers' annual have decided to defer the publication of Volume 22 (1917) until next spring.

Reflex Cameras and Focal Plane Shutters. A new edition of this popular handbook (The Photo-Miniature No. 151) has just been issued. It is the only work at present available which gives the plain facts about the advantages of the reflecting mirror types of cameras (Graflex, etc.) and the use of the focal plane shutter. 48 pages; illustrated. Price, 25 cents.

"American Photo Engraving Industry." The U. S. Government Census Bureau has recently published statistics covering this industry for the year 1914. In that year there were in existence in this country 376 photo-engraving plants, employing 6,211 workers. The year's wages amounted to $6,157,000 and the cost of the materials used was $2,798,000, the value of the finished products being given as $15,539,000.

"French Army Propaganda Photography." Under this title Francis Miltoun describes, in a recent issue of *Photography* (London), a photographic auto car used by the French Government in its army photographic service at the front, and for the transport of films and plates from the front to the army headquarters in Paris. There are hundreds of these cars, fully equipped for photographic work, in the photographic and Kinematographic Section of the French army, the service covering the making of photographs for staff and publicity purposes at and behind the front, and the preparation and distribution of all kinds of illustration material concerning the progress of the war, in the form of photographs for newspapers and magazines, lantern slides and kinematograph films.

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Specialized Commercial Methods

A few days ago I found myself perplexed by a question which I could not answer—about a very simple matter, but beyond my experience and book knowledge. It often happens so—so little do I know about so many things. But I knew where to find a man who could answer my question, which is the next best thing to being able to answer one's questions oneself. So I sought the man and found him, and the answer to my question, on the top floor of a New York skyscraper. The place was the photographic department of the New York Edison Company, and the man's name, as he told me, was Phelan—A. B. Phelan, with the explanation that there were two men of the same name, with the same initials, in the same field of work, which is confusing but apparently without remedy. I do not know the other one, but the A. B. Phelan I met is a big, round, good-natured chap, and a specialist in commercial photography. His department is wholly occupied with the photographic work required by the New York Edison Company and its branches, with an output of over 25,000 8 x 10 negatives, 5,000 enlargements and from 50,000 to 100,000 prints per year.

Of course, I was intensely interested in all I saw and heard of the electrical way of doing things in photography, and some day we may have the story told, in part at least, in these pages. One of the things I liked most was an arrangement of three 50-inch Cooper-Hewitt tubes banked on either side by four rows of type C, nitrogen lamps, 5 lamps in a row, mounted on a white board about 5 feet square. The combination gave a flexible light source, adjustable at any angle on an easily movable standard, with a softly diffused, normal colored light, fast enough to make moving pictures in 1-30th second and ordinary studio lightings with an exposure of one second.

But the net result of my adventure is found in the following pages, wherein an expert photographer of long experience tells us of the processes and formulas employed in just such a studio as that mentioned above, but concerned wholly with printing and enlarging on a big commercial scale. Seeing what I saw during my visit to Mr. Phelan, I came away with the idea that an account of the working methods of such a studio would surely be suggestively interesting and practically useful to the readers of The Photo-Miniature. Here it is, told in the lively fashion used by those who know whereof they speak, and bristling with information of the most practical sort. Editor.

Prints by the Thousand

The demand for photographs in large quantities for all sorts of trade and advertising purposes has increased enormously of late years, as part of the development of commercial photography. The use of photographs for display advertising in the moving picture industry is a case in point. Here the demand is for thousands of prints from a few negatives, to be produced at short notice and at a low price. It will be interesting to see how it is done by the modern commercial studio.

Advertising the "Movies"

There are more than 17,000 moving picture theatres in the United States. In the lobby or entrance of every theatre, however humble, you will find one or more frames displaying from 6 to 10 photographs, about 8 x 10 inches, depicting characters or incidents in the photoplay featured at that theatre for that day. These are technically known as "stills," being made, not by enlargement from the picture reels of the plays themselves, as one might think, but by special sittings or posings, separate from, though made at the same time as the picture reels. Portraits of well-known players—not in character—are also largely used for similar advertising purposes, as well as for newspaper and magazine illustration.

A Big Field

When it is recalled that most theatres run a new photoplay every day, and that there are hundreds of more or less famous players featured in the thousand or more different film pictures current in a single year, it will be realized how big a part the photograph plays in this nation-wide, all-the-year-round advertising.

Painting Machines

To meet the demands of such a market the old hand and daylight printing methods are, of course, totally inadequate. Consequently the firms catering to this business have been obliged to devise new printing machines and appliances, and to systematize their working methods to facilitate the production of large quantities of prints in a short time. These printing machines use the electric light in one form or another as the illuminant for exposure and the modern development papers. Small machines of this sort, capable of turning out hundreds of prints per hour from a single negative, have already been introduced for amateur and professional use, and may be seen in the trade catalogues and at the dealers' stores. In commercial studios, however, they are specially designed and built to meet the requirements of the larger volume of business, and are generally more or less automatic in operation, giving as many as six or ten prints from as many negatives on a single sheet of paper at one exposure. The methods of development and the after-treatment of the prints are similarly systematized as far as possible to effect economies in the time and cost of production.

A "Printer" Described

The general type of such a machine is seen in Fig. 1. It is practically a table in the top of which is fitted a sheet of thick glass to form a printing bed for the negatives, this bed varying in size according to the number of negatives to be accommodated. Sometimes this printing bed is removable to facilitate the adjustment of negatives upon it ready for printing. Under the printing bed, enclosed in a box or chamber, a number of incandescent lamps, or an arc lamp, or an M-shaped Cooper-Hewitt tube, is fixed to give the volume of light necessary to yield well-exposed development paper prints from an average negative in not longer than 3 seconds. In practice the light is so controlled that it will give automatic exposures of any desired period by releasing a lever or similar device. Provision is also made, on the score of economy, for using part only or all of the light as may be desired.

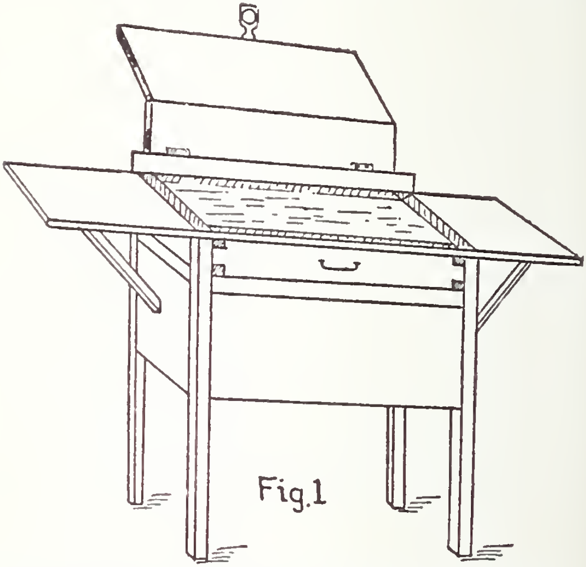


Fig.1

Diffusing Screens Between the printing bed plate and the light-box or chamber, there are usually one or two grooves, into which are slid (1) a diffusing plate of opal or ground glass to equalize the illumination over all parts of the printing bed plate, and (2) a sheet of thick glass upon which may be adjusted (quite near to the printing bed) a vignetting or masking device, pieces of glass or colored tissue screens, etc., to secure the uniform printing of negatives of different densities, or to build up, hold back, or otherwise effect local improvements in any particular negative or part of a negative needing this help during exposure to give the best possible print.

Adjusting the Negatives The negatives to be printed from, whether on glass or simply films, are secured in position on the printing bed by means of black, gummed paper strips, so fitted as to give a quarter of an inch white margin to the prints on development. In some cases, where stripped film negatives are used, a set of negatives is affixed to a separate glass plate about 20 x 24 inches, this being done in the workroom, where any necessary manipulation of the negatives, screening, vignetting, etc., can be more easily done before placing the set upon the printing bed of the machine.

A Tip for the Reader The amount of control over printing quality secured by this preliminary preparation of the negative is obvious, and should commend the use of such an arrangement to every professional or amateur who can spare a table for this purpose in his workroom. Where the adjustment or modification of the negative is to be done on the printing bed of the machine itself, the light equipment provided for exposure gives a most desirable illuminant. A safelight bulb to permit the adjustment of paper to the negatives must be included in the light-box equipment provided.

The Cover That portion of the table occupied by the printing bed plate is, of course, fitted with a hinged top or cover, lined with thick felt. When all is ready for exposure, this top is brought down over the negatives and paper in position on the printing bed and tightly clamped, so that the paper and negatives are in absolute contact. At this point the exposure is given by means of a clock beating seconds, or a foot treadle which turns on the light, or any other device which will give a timed exposure. The hinged top is also fitted with an arrangement automatically releasing and lifting it when the exposure time is over, so that the exposed paper may be removed and a new sheet adjusted over the negatives ready for the succeeding exposure.

Rate of Production

With such a machine, fitted to give six 8 x 10 prints per exposure on a sheet of development paper 20 x 24 inches, the operations of laying down and adjusting a sheet of paper to the black marginal lines on the bed plate, clamping down the cover and making the exposure, can be completed within 20 seconds. This means exposing 180 sheets and getting 1080 prints per hour, the supply of paper being piled ready for use at one side of the machine, and re-stacked after exposure on the other side of the machine. I have seen automatic printers of this sort expose 300 sheets of paper 20 x 24 inches within an hour, thus giving 1800 prints. This was quick work and called for expert handling.

A Smaller Machine

For the finer grades of portraiture use is made of smaller machines, printing two 8 x 10 negatives on a sheet of paper 10 x 16. Such a machine is seen in Figs. 2 and 3 (the F & S Professional Printer). The negatives, of course, are first manipulated by tissues, ground glass, etc., so as to be perfectly matched in printing density if uneven in this respect. Where this adjustment is not possible, each negative is printed from separately, but this halves the print production in any given time. This particular printer has nine 40-watt tungsten lamps in three rows, in addition to one ruby lamp to permit the adjustment of the paper on the printing bed before exposure. It is operated by a foot treadle so that the operator has both hands free for the handling of the paper.

Different Sorts of Paper

The commercial printer necessarily takes full advantage of the many different classes of development papers on the market. Thus, where soft, dainty effects in portraiture are needed, or where the negatives are inclined to be at all contrasty, a paper yielding soft prints is used. Similarly, a paper giving crisp prints, inclining to stronger contrasts of tone, is used for printing from thin, soft, detailful negatives. When the large numbers of prints produced per day and the stock carried of the

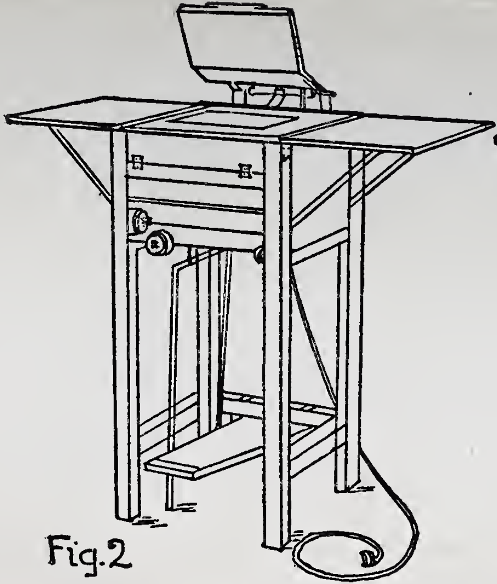


Fig.2

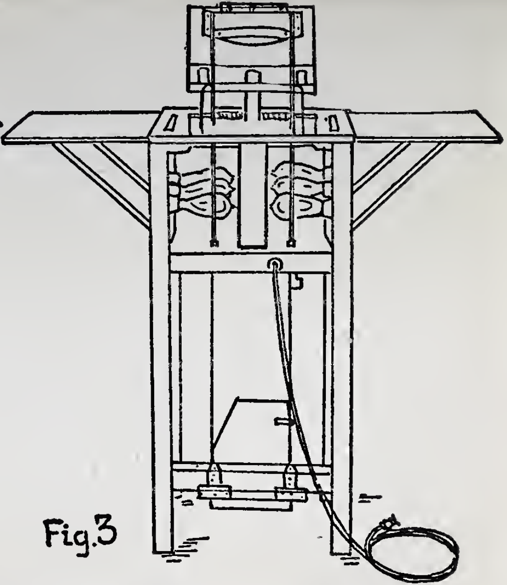


Fig.3

The F & S Printer—showing the construction of the machine from the front and the interior of the light box from behind various sorts of development paper are considered, it is seen that the modern commercial studio is a very large consumer of this class of printing papers. As a general thing, for convenience in handling and use, the sorts of photographs here mentioned are made on heavy-weight paper—Azo being a general favorite. Much single-weight paper, however, is used where the after-use of the prints will permit of this economy.

Testing for Exposure

As soon as a set of negatives has been properly adjusted on the printing bed of a machine, which includes the masking, screening, vignetting, etc., a test is made with the paper to be used in order to get the exposure time required for the negatives. For this strips of paper are cut to about one and a half inches in width and long enough to cover all the negatives arranged on the printing bed. This being laid on the negatives, the cover of the machine is clamped down and an exposure of three or more seconds is given, this depending on the quality of the negatives, the light used, the paper and the judgment of the operator. After exposure these strips are developed, which tells (1) whether the exposure must be lengthened or shortened and (2) whether the negatives have been so adjusted or modified as to give the desired results where several are printed together at one time. This having been done satisfactorily and the correct exposure being determined, the paper needed for the order in hand is cut to size, piled face down at one side of the machine (the room being properly "safe-lighted"), and the printing is proceeded with, each sheet, after exposure, being piled on the opposite side of the machine ready for development.

Bordering Negatives

Almost all the photographs made for advertising and illustration uses are printed with a narrow white margin. This is provided for by bordering the negatives before printing. This is a tedious and messy job unless handled with neatness and dispatch. We need a roll of black paper, one-eighth or one-quarter of an inch wide, gummed on one side with a strong adhesive such as fish glue. A strip of this sufficient in length for the negative is cut from the roll and laid, ungummed side down on a table.

Alongside, laid film or face side down upon a pad of felt, the negative to be bordered is placed. A tuft of moderately wet absorbent cotton is now passed over the gummed side of the paper strip. It is then quickly turned over and adroitly and firmly placed along the edge of the negative on the glass side. This operation is repeated until all four edges of the negative are neatly bordered, without a trace of gum or moisture being allowed to touch the film side of the negative, as this may later need treatment of various kinds to adjust it for printing. The best results are obtained when a number of negatives are bordered at one time and one prepares for the job with the deliberation it requires.

Vignetting

When the prints are to be vignetted, as is often done in the case of portraits of women, the method employed differs widely from the old-fashioned way of working with saw-toothed cutouts and absorbent cotton. The following simple and rapid plan is advised. It permits the negative to be placed, glass side down, upon the printing bed of the machine, and yet gives the delicately vignetted effects desired. It requires an air-brush and a supply of liquid opaque. With these at hand, a supply of thinned opaque is put into the color fountain of the air-brush, the bordered negative (well cleaned) is taken in the left hand, and the opaque or color is sprayed on the glass side of the negative in such a way that the center, or that portion of the plate which is to be printed out, i. e. the head and shoulders in a portrait, are left clear, and the surrounding portions of the negative covered with varying thicknesses of the opaque, graded from complete opacity at the edges of the negative to a very delicate shading near the outlines of the hair, head, neck, and bust. If the opaque has been allowed to cover up any portion of the image which must be shown in the print, this is cleaned off by the skilful use of a moistened mop, made by tying a small piece of absorbent cotton to the end of a slender strip of wood. Sometimes this removal of opaque can be done with a dry mop. A soft edge is imperative, so that the shading of the background of the portrait grows imperceptibly deeper in tone as it approaches the outlines of the head or figure.

In any event the operation of the air-brush and mop in making a satisfactory vignetting mask or screen on a negative is a delicate bit of work, in which dexterity comes by practice and cannot well be learned from books. The air-brush is an indispensable tool in most commercial studios and has a thousand and one uses in professional photography, more especially in portraiture, so that it is well worth looking into.

Making an Opaque

Moist opaque is obtainable commercially, but the formula here given will enable the reader to prepare it more cheaply than he can buy it and, at the same time, secure a better opaque than I have yet found in the stores. This opaque, when thinned, is suitable for use with the air-brush as above, and in its normal state can be used for blocking out and modifying negatives in the usual way.

Formula for Opaque

Mix the following in the inner vessel of a double boiler or oatmeal kettle: Yellow dextrine, 8 ounces av.; cold water 15 fluid ounces. When thoroughly mixed, heat this to boiling in the outer vessel of the kettle, stirring vigorously for thirty minutes. As soon as the dextrine is thoroughly dissolved, add 3 drams of formaldehyde, stir again for a few minutes and allow to become cold. This constitutes the syrup of dextrine which is used as a binder for the coloring matter of the opaque.

To prepare the opaque, take red lead, 10 ounces av.; lampblack 1½ ounces av., and mix them thoroughly in the dry state. Now work the mixture into a stiff paste with 3 ounces of hot water and add to this 6 fluid ounces of the dextrine syrup above. Stir well and then strain the mixture through a double thickness of very fine cheese cloth (anglice, buttercloth). Allow it to stand a few hours to rid the mixture of absorbed air when it is ready for use. Store in jars or wide-mouthed bottles of convenient capacity.

A Fine-grained Opaque

A very fine-grained opaque is prepared as follows: Mix dry, fine rouge (as sold for silver polishing) 8 ounces av.; best quality lampblack 2 drams. Work into a paste with equal parts of alcohol and water made up to

1½fluid ounces. Add to this 6 ounces of the dextrine syrup already mentioned, and stir the mixture well with a flat bristle brush. When thoroughly and smoothly mixed, add 20 drops of nitro-benzole, known as oil of mirbane and incorporate this well with the aid of the bristle brush, when the opaque will be ready for bottling or use. See that it is protected from the air and consequent evaporation in storage.

Reducing Negatives

In some cases it will be necessary to reduce slightly the density of negatives to match them up with others in a set for printing on a single large sheet of paper; or it may be that a negative is so dense that it will take so long to print that the cost of the electric light is worth consideration. In such cases the following reducer will be found altogether efficient and dependable. It is suited for plates or films and in action it effectually reduces the high lights of the negative (opacities) without proportionately reducing the delicate shadow details which should be retained.

Reducer

Dissolve 240 grains perchloride of iron in 16 fluid ounces of water, and add 480 grains of oxalic acid (poison). When complete solution has taken place, pour 4 or 8 ounces (according to the size of the negative to be reduced) into a clean tray, wet the negative well in running water until the water is seen to flow cleanly and evenly from its film surface, and then place the negative, film side uppermost, in the reducing solution. Watch the progress of reduction carefully, rocking the tray gently to secure uniform reduction and, when the reduction has proceeded to the desired point, wash the negative or film in running water and set aside to dry. This reducer is not rapid in action but gives the desired result if given sufficient time.

A Remedy for Patches

Sometimes it will happen that a negative will show an uneven background, with spots or patches of less density than those parts immediately surrounding them. The best remedy for this defect in machine printing is to shade or screen the parts of the negative around the patches with tissue paper or pieces of glass properly placed on the diffusing plate of the machine, and give a longer exposure than usual, so that the uneven patches will print out further than the surrounding parts held back by the screening. This will aid in making the background develop out as a darker and more evenly toned mass, with the less dense patches less apparent than they originally were.

Having followed the making of large quantities of prints up to the end of exposure, we now turn to the methods used in development and the after processes, by which it is possible to finish and deliver thousands of 8 x 10 prints per day, week after week, "without turning a hair," as the phrase runs.

Apparatus Equipment

First, however, the trays, tanks, and mechanical equipment used in this sort of work claim our attention. Then we will gather the formulas employed in the various processes; after which the working methods will offer more interesting reading. The equipment of the modern commercial studio is designed for convenience in working and stoutly constructed to withstand hard wear and tear. To the same end they are made in such sizes or dimensions as to afford ample working room for the largest sheets of paper in general use, which is found to accelerate the speed of production. The point is one to be noted by the general reader in passing, since so many amateurs and professionals cramp themselves for room in their equipment, to their after discomfort and the impairment of their efficiency.

Developing and Acid Trays

The trays used in development are usually made of wood, after the form seen in Fig. 4, lined with strong unbleached muslin. The joints and seams of the wooden bottom and sides are put together with a thick varnish cement, such as Owl or Probus water-, acid-, and alkali-proof varnish, which practical experience has proved to possess a flexibility or elasticity after long usage with alkaline and acid solutions not found in other varnishes of this class in the market. White lead is quite unsuitable for this purpose, since the acetic acid of the acid bath or hypo solution would quickly eat this material away, forming acetate of lead which is soluble in water, and so leading inevitably to leaky trays. Either of the cement varnishes mentioned can be obtained from your dealer.

Having been carefully jointed and put together with this thick varnish cement, the trays are clamped with strong twine to ensure close joints and set aside to let the cement set and dry. After a day or two the twine is removed and each tray is given a thick coating of the cement varnish, which should be well brushed into the wood, both inside and outside being so treated, after which the tray is laid aside for a day or two until the varnish has dried and set. This done, the trays are ready for lining. This is done by first cutting strong, unbleached muslin a little larger than the size of the inside of the tray, and fixing it thereto by a light coating of varnish, so that the outer edges of the muslin lining can be neatly tacked all around the outside edges of the sides of the tray. After this a second coating of cement varnish is applied to the inside of the tray and, when thoroughly set and dry, it is ready for use. As many as twelve such trays are often in use at one time in a busy studio, for development and similar uses.

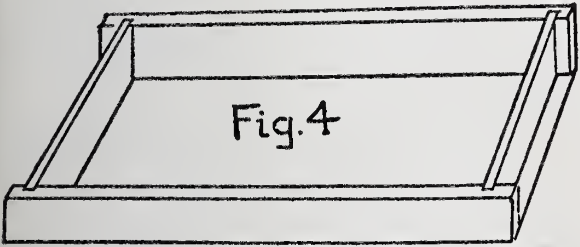


Fig. 4

Print Testing Tray

For the general purpose of a print testing tray, which may be used by three or four operators at the same time, a large tray 5 feet in length, 2 feet in width and 5 inches deep, may be constructed as above outlined (see Fig. 4). The regular developing solution is poured into this tray until a depth of about an inch covers the bottom of the tray, which will provide a sufficient quantity for the day's testing of exposures, as already mentioned.

Washing and Fixing Tanks

For washing prints, two large triple tanks will be required, as shown in Fig. 5. These are strongly built of wood, all nails being well sunken and the head holes puttied, after which they should be given two good coatings of the cement varnish inside and out, no muslin lining being needed in this case. In use these triple washing tanks stand end to end, the water being supplied by a pipe at the back perforated with small openings, the flow of water into each division of the tanks being regulated by the capacity of the outlet in each division, as roughly sketched in Fig. 5, by which means a constant supply of running water is assured.

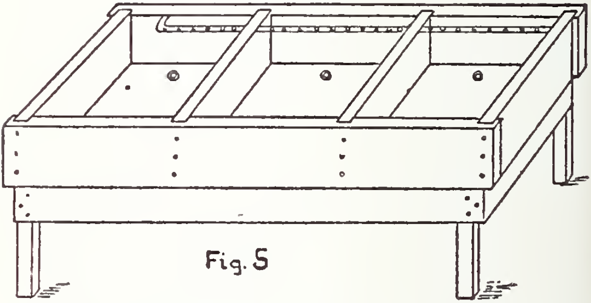


Fig. 5

The size of each division of one of these triple tanks should give ample room for handling the largest sheet of paper in use. In depth they should be 12 inches. They are constructed of 2-inch yellow pine, and all the joints and seams are cemented with the varnish already mentioned. A similar triple tank (without the water-supply pipe) should be provided for the fixing baths, each of the three divisions having a capacity of 30 gallons of hypo fixing solution when filled to half its depth, viz., 6 inches or so.

The enameled iron vessels and pitchers used in this department should also be given a coating of the cement varnish for their protection.

Hypo Tanks If the common sense plan for dissolving hyposulphite of soda in large quantities be adopted as described in detail below for use in making up fixing baths as required, two 52 gallon barrels (acetic acid or wine casks) will be needed, with the stand and hypo racks shown in Fig. 6. Otherwise, the hypo baths must be made up in the triple fixing tanks described above, as needed for use.

Dissolving Hypo-soda The addition of hyposulphite of soda to water reduces the temperature of the latter considerably and, even when warm water is used, the making of a hypo-soda solution is tedious work, calling for much time and stirring. For this reason the following plan for dissolving hypo-soda in large quantities, so as to have on hand an ample supply in the form of a saturated solution, ready for use when needed, is worth the initial trouble involved.

Equipment Procure two 52-gallon casks (such as acetic acid or wine containers), mount them on a sturdy wooden stand, as shown in Fig. 6, with sufficient height from the floor to allow a pail to stand under the stopcock when the solution is to be withdrawn. Fit the two casks with wooden stopcocks having no metal fitments or attachments, about as shown in Fig. 6. Now make a strong wooden frame, as shown at C, large enough to fit the top of the barrel and having an open space at the center about 7 inches wide and 16 inches long, within which space fit a stout sack having a fine but firm mesh, fastening it to the frame with nails having broad, flat heads, the top edges of the sack being folded double before nailing so that there will be no rough edges to fray out in use—all as shown at C and D, Fig. 6.

Making the Solution In practice, the casks are filled half full of cold or warm water, the rack and its sack are hung so as to rest upon the open top of the barrel, as indicated at E, and 60 to 80 pounds of hypo-soda are placed in the sack. A pailful of hot water is now poured over the hypo-soda in the sack, whereupon the hypo shrinks and rapidly dissolves. The sack is again filled and this process repeated until the barrel is fairly full, holding about 50 gallons of solution.

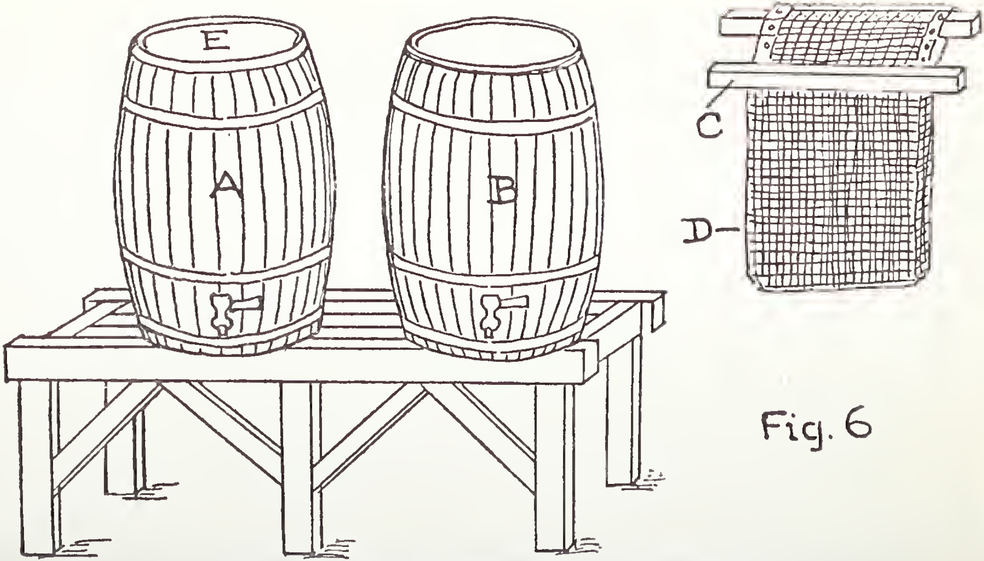


Fig. 6

Barrels as described for making hypo solutions in bulk

If the hypo sack is kept replenished until the solution will no longer dissolve the hypo, and the contents of the tank are vigorously stirred from time to time, the result will be 50 gallons of a practically saturated solution of hypo-soda, ready for use at any time, which must be diluted with an equal bulk of water for a fixing bath for most development papers, the degree of dilution varying with the brand of paper used. Some papers require more and some less dilution—as to which experience will quickly show.

Advantages

This method is a very practical convenience and time-saver in studios handling large orders for prints. In the triple fixing bath already described, for example, for fixing hundreds of printed sheets 20 x 24 inches, the three divisions of the tanks require from 75 to 90 gallons for use at one time. Unless the contents of the barrel are stirred now and again with a stave of white pine, it will be found that the solution at the bottom of the barrel (that withdrawn at the stopcock) will be of greater strength than the solution in the upper half of the barrel. For this reason a hydrometer (or argentometer) should be kept at hand to ascertain the actual strength of the hypo solution withdrawn for use. It should register 80° on the hydrometer scale for the purpose here intended, previous to its dilution for actual use. If two barrels occupy more space than can be afforded, then a single barrel may be used.

Crocks for Solutions

For the preparation of the different developing, acid, hardening, and similar solutions needed for the manipulation of prints in large quantities, at least half a dozen stoneware crocks will be needed, having a capacity of 12 gallons apiece. A few smaller crocks will also be useful. All should have lids to protect their contents from dust and dirt. A 12-gallon crock will hold 10 gallons (comfortably and without fear of spilling) of a concentrated solution, which, diluted with an equal volume of water, provides 20 gallons of the right strength for general use, ready for use when needed. Such crocks can be purchased from dealers in chemical engineers' supplies.

Hints on Mixing

In making up the development and fixing baths which follow, hot water is used to dissolve the three principal chemicals, cold water being added to give the required bulk and ensure complete solution. It will be found that the addition of sodium carbonate will cause the temperature of the solution to rise considerably. To promote complete solution and admixture of all the ingredients, it will be necessary to stir the mixtures vigorously after each addition of chemicals. A stave of white pine is best suited for this purpose. All solutions so prepared should be allowed to get thoroughly cooled before use. This will also ensure that any superfluous matter will settle to the bottom, leaving the bulk of the solution clear and ready for use. As a rule these working solutions are prepared in the late afternoon and left to stand over night, so that they will be in good condition for use during the day following. Needless to say that the crocks should be cleansed before use, and that they should be marked and used exclusively for developing and fixing solutions respectively.

Ten-gallon lots of developer have been found to be the most practicable quantity to prepare and, since most photographic solutions improve in potency if prepared some time before use, it is wise to have an extra crock of developer ready on hand in case of accident or other urgent need. The same quantity of hardening solution is also desirable. The hyposulphite fixing solutions are prepared in larger lots and in a different way, as already described.

Formulas

The following formulas for developing solutions are given as having proved dependable in a wide range of experience:

"Hard" Developer

Formula, No 1, for Crisp or Contrasty Prints from Soft Negatives. Weigh out the following: A. Paramidophenol-hydrochloride (Kodelon or other reliable brand), 2 ounces. B. Hydroquinone, 8 ounces. C. Sodium sulphite (dry), 1 pound, 14 ounces. D. Sodium carbonate (dry), 5 pounds, 10 ounces. E. Potassium bromide, 6 drams.

Now into a clean 12-gallon crock put 1 gallon of hot water; in this dissolve A and B by vigorous stirring; then add 9 gallons of cold water, and add C, D, and E. successively, stirring well after each addition to ensure complete solution. This will give 10 gallons of concentrated "Hard" developer, which for use with most brands of development paper must be diluted with an equal quantity of water.

"Soft" Developer

Formula No. 2—for Soft Effects in Prints from Strong or Contrasty Negatives. Weigh out the following: A. Paramidophenol-hydrochloride (Kodelon or any similarly reliable brand), 2½ ounces. B. Hydroquinone, 2½ ounces. C. Sodium sulphite (dry), 1 pound. D. Sodium carbonate (dry), 4 pounds. E. Potassium bromide, 1½ ounces. As in the preparation of No. 1, so here, dissolve A and B in 1 gallon of hot water, add 9 gallons of cold water and then add C, D, and E, stirring well to ensure thorough solution. When cold, dilute with an equal volume of water for use. It will be well to mark the two crocks so that you cannot mistake the one developer for the other, which might involve serious loss.

Non-abrasion Developer

When prints are made on glossy surfaced development papers, a serious difficulty is often experienced by the appearance of dark abrasion marks all over the surface of the prints. These are caused by electrical action resulting from one sheet of paper rubbing against another, this producing a slight reduction of the haloid silver salt which becomes apparent on developing the prints. To prevent this defect what is known as a non-abrasion developer is employed with glossy surfaced papers of this kind.

Iodide Solution

For this the following stock solution is prepared: Dissolve 1¼ ounces (600 grains—to be exact) of potassium iodide in 16 fluid ounces of water. For use, take 1½ fluid ounces of this stock solution, add 4 ounces of water, and add this 5½ ounces of iodide solution to each quart (40 ounces) of developer—either No. 1 or No. 2 as the case may be. When this non-abrasion developer is used, note that the prints should be fixed for fully 15 minutes. After this they are well washed and finally the surface of each print is carefully wiped all over with a tuft of wet absorbent cotton and laid aside to dry.

The Acid Bath

As soon as the prints are developed, they are at once put into what is known as an acid bath which stops the progress of development and ensures freedom from stains in fixing. This acid bath is prepared as follows: Into a clean 12-gallon crock filled with cold water put 64 fluid ounces of acetic acid No. 8. In practice the prints are quickly bathed in this solution and passed directly, one sheet at a time, into the fixing bath.

Hardening Solution

In the preparation of fixing solutions for development papers, a hardener is usually added to the bath. To prepare this hardening solution dissolve sodium sulphite (dry), 14 ounces, in warm water, 1 gallon (128 ounces); when dissolved, add powdered alum (white), 2 pounds, and acetic acid No. 8, 88 ounces.

Fixing Solution

The hyposulphite of soda fixing bath is made up by dissolving 18 pounds hyposulphite of soda in 25 gallons of warm water. When thorough solution has been obtained, add to this 5 pints of the hardener, prepared as above, when it is ready for use.

To use the saturated solution of hyposulphite of soda (described on an earlier page) in making up this fixing bath, take 12½ gallons saturated solution hypo (80° argentometer or hydrometer test), add an equal bulk of water, and then add 5 pints of the hardener given above. The degree of dilution, however, will be varied according to the particular brand of paper in use, following the makers' formulas.

Developing Prints

The development of the large sheets of exposed paper, each sheet giving two to six prints, does not present any special difficulty. The exposures have been standardized to give uniform prints in a known developer, and the latter has been carefully compounded according to the formulas already given. The operation of development, therefore, becomes more or less mechanical, a matter of careful timing and dexterity in the handling of large sheets of paper in the solutions. Naturally the handling is easier and less liable to develop trouble when the heavy-weight papers are used, as compared with papers of normal weight.

Preparation

As a first precaution the operator will take care that the temperature of his developing, acid, and fixing solutions is as near uniform as possible. Then he will see to it that a plentiful supply of fresh solutions is at hand for all his needs. And, finally, he will supply himself and his assistants with rubber gloves, for the protection of the hands and greater convenience in working.

Protecting the Hands

A word about the protection of the hands may be profitable before we go further. Efficiency in working with chemical solutions on a large scale depends largely upon keeping the hands in good condition. Constant immersion of the hands in alkaline and acid waters causes the skin of the fingers to crack or split, giving rise to painful sores, causing great discomfort and tending to inefficiency in producing good results. It is, therefore, well worth while to look after one's hands, and here an ounce of prevention is worth a pound of cure.

Rubber Gloves

Cheap rubber gloves are doubly expensive; get the thick, substantial variety, even if they cost a trifle more. Some expert developing operators use two gloves upon the right hand for greater comfort. This precaution overcomes the risk of a corner of a sheet of thick paper penetrating the glove at any point, thus permitting the developing solution to enter and soaking the hand. Many operators object to the use of rubber gloves because of the difficulty of removing, but this difficulty can be obviated by rubbing the hands with glycerine or talcum powder before putting on the gloves. The liberal use of talcum powder on the hand and on the first glove is very advantageous when two gloves are worn on one hand, as above mentioned.

Developing Method

Due preparation being thus made for development, a batch of exposed sheets is placed conveniently at hand, the top sheets being spread to overhang each other a little, so that the operator can take hold without wetting the sheet. A tray having a depth of 6 inches is now filled with developing solution to a depth of 2 or 3 inches, the "hard" or "soft" developer being used as the prints in hand may require.

Handling the Prints

The topmost sheet is now taken in the left hand and, the far, top corner of the sheet being gripped between the index finger and thumb of the right hand, it is slid gently but continuously, face down, into the developer and then quickly reversed so that it lies face up, wholly covered by the developing solution. The progress of development is now noted by a clock near at hand, so that the operator can gauge the time for withdrawing the sheets as developed.

This being noted, a second exposed sheet is immersed in the developer with quick, deft motion, face down upon the sheet already being developed. After this, a third sheet is introduced, face down upon the second sheet and then reversed so that it lies face up, whereupon a fourth sheet is immersed, and so on until as many sheets of exposed paper are introduced into the developing solution as the operator can conveniently handle. This will depend on the rate or time of development, varying generally from six to twelve sheets, according to the skill of the operator. This method is based upon the withdrawal of the undermost sheet from the solution as soon as development is complete and the immersion of a new sheet on top of the uppermost sheet in rotation. After the first few sheets have been immersed as above outlined, it will be found that the development of hundreds of sheets of exposed paper can be carried on continuously by this method of alternate withdrawal and supplying new sheets of paper.

Watchful Waiting

During the whole time of development the operator will frequently pat the prints with the palm of his right hand to keep them well under the solution and also to give a little motion to the developer. And all the time, as a matter of course, he is keeping an eye to the lowermost sheet, and to the exhaustion of his developing solution as indicated by the slowing of the rate of development and the appearance of the prints.

Wholly Practical The practicability of this method of wholesale development is, of course, based on the use of a single brand of paper for one order, the use of a set of negatives standardized as to average printing density and uniform exposures. With these details assured, however, it becomes wholly practical and, in the hands of an expert, is capable of giving great quantities of prints per day. In large studios as many as eight operators are employed at as many developing trays at one time.

The Acid Bath As quickly as each sheet is developed, it is removed from the developing tray and immersed for a moment or two only in the acid stop bath for which a formula has already been given. This bath is placed near the developing tray and the immersion of the developed sheet is done by the developing operator.

The Hypo Boy and Fixing At the acid stop tray stands an assistant known as the Hypo Boy, whose duty it is to remove the developed sheet from the acid bath as soon as it has been immersed and at once transfer it to the hypo-hardener fixing bath which is placed on his right side.

This operation must be performed quickly, the print being removed with the left hand alone, and thrown face down into the fixing solution, where it is pressed down with the right hand, so that it is completely immersed with a twirling or oscillating movement, to obviate streaks or uneven patches in the print, caused by the hypo solution not reaching all the surface of the print evenly and at one time. To handle large sheets of paper in this way, rapidly and without "kinking" or creasing the prints by roughly poking them with the fingers, requires dexterity and practice.

Blisters At times, where large numbers of prints are so treated, regardless of their size, blistering of the surface of the prints will occur, i. e. the emulsion carrying the picture image will lift in blisters varying in size from a pea to the palm of the hand. This trouble is generally due to great unevenness of temperature in the solutions, e. g. the transfer of prints from a warm developing solution to a cold acid bath or hypo solution. The remedy is to use a hardening bath of a gallon of hardener (see formula already given) to 10 gallons of water in place of the acid stop bath. The developed prints are placed in this bath directly from the developer, and allowed to remain therein for a minute or two before their transfer to the fixing bath. It is well, also, in such cases to slightly increase the amount of hardener in the fixing solution, adding, say, 2 pints of hardener to each 25 gallons of fixing bath.

The fixing of large quantities of prints in this way, necessitates the use of three fixing tanks, each tank containing 50 gallons of hypo-hardener solution. After four hours' use these fixing solutions will need renewal. Here is seen the advantage of preparing hyposulphite solutions in large bulk, according to the method given on earlier pages. In some studios as much as 200 pounds of hyposulphite of soda are used daily, the solutions being prepared at night for use the following morning, as already explained on page 382.

Saving the Waste

Here I may mention that the "spent" fixing solution should not be thrown down the sink, but saved in barrels for treatment by the "Saving Wastes" method to be explained later. Thus in some large studios the saving realized by intelligent treatment of these "wastes" realizes a sum sufficient to pay for a large proportion of the chemicals used in the studio.

Caution as to Stains

Before passing from the operation of fixing the prints, two points deserve special mention. First: the common practice of placing prints directly from the developing solution into the fixing bath should never be adopted where quantities of large prints are being handled. It is a bad practice, even with small prints, but with numbers of large prints handled quickly, it is certain to produce bad surface stains which are very diffcult to remove from the prints. I have seen large batches of prints spoiled in this way, in a single day's printing, by simply omitting the use of the acid-stop bath to save time. The acid bath is an inexpensive detail, but works for practical saving.

Caution as to Formaldehyde

Second: where glossy development paper is used in summertime, it is often advised to add formaldehyde to the first wash water after fixing, to harden the film surface of the print so that it will not stick to the ferrotype plate used later on to finish glossy prints. This use of formaldehyde almost invariably produces a half-sulphurized print, i. e. one in which the highest tones are entirely bleached out and the halftones decomposed to a dirty yellow. Experimentally it is possible to produce pleasing two-toned effects in this way on glossy paper, but the practice is not advised as a general thing for the reason given above.

Washing after Fixing

The washing of large prints in quantities is a tedious operation, no method having been found superior to the old-fashioned way of giving each print separate handling, pressing it well down in the first wash water tank, using constantly changing water, and then transferring it, with similar manipulation, to five or six tanks successively, these changes occupying at least half an hour. The washing tanks used are shown in Fig. 5, on an earlier page. Two such tanks are placed together, end to end, for convenience in manipulation.

Drying the Prints

When the prints have passed through the sixth washing tank, they are removed singly and passed through the rubber rollers of a domestic clothes wringer situated near the sixth tank. The excess of surface water is thus removed from the print, after which it is laid between sheets of non-linting blotter, such as Photo Finish World Blotter, light pressure being applied over the whole print to make it completely surface dry. It is now laid, face up, upon a screen, consisting of a light wooden frame covered with cheesecloth or coarse muslin, each screen being placed on top of another, from which it is separated by a wooden angle piece so that a current of air can reach the print. A pile of such screens is located on a stand raised above the floor, so that the warmer air in the upper part of the room aids the drying of the prints. This method of drying applies to all matt or plain surface prints. In its place, of course, any one of the drying machines in the market can be used. Of these, the Duplex Rotary Automatic Print Dryer (Herbert & Huesgen Co., New York) is the best within my knowledge.

Glossy Prints

Glossy surfaced prints, on the other hand, are dried in a different way in order to retain the high gloss of their surface. Here the prints are usually cut to size 8 x 10 or 10 x 16 inches, and squeegeed to ferrotype plates, which latter have first been prepared with a very thin coating of paraffin wax. The method of preparing these plates will first be given, and later the placing of the prints on the ferrotype plates and their drying.

Formula: Waxing Solution

Make up a solution of benzine, 1 pint, (20 fluid ounces) and paraffin (cut into thin shreds) ¾ ounce. This is the usual waxing solution but is highly inflammable. To prepare an equally efficient solution, not inflammable, dissolve 1 ounce of shredded paraffin in 8 fluid ounces of benzine and add 8½ fluid ounces of tetrachloride of carbon.

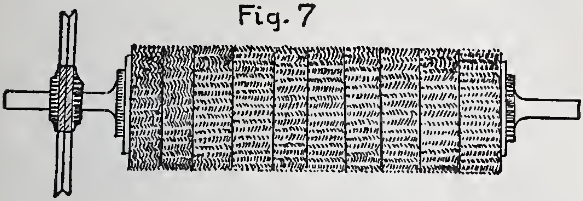
Waxing the Plate

To prepare the plate, a very small quantity of this waxing solution is poured on to a piece of soft rag and quickly applied, with a circular motion, to the clean surface of a ferrotype plate of the size required, i. e. larger than the print in hand. A very thin, even coating of the wax is wanted. After the waxing has been applied as indicated, the plate is given a second polishing with a new piece of soft rag.

A Rotary Polisher

This final polish, however, is best given by the employment of a rotary buff, driven by a small electric motor. Such a buff is made by affixing a dozen rag wheels or buff wheels, of the kind used by silver polishers as seen in Fig. 7, side by side on a steel shaft and mounted in bearings on two small iron standards, with a small, grooved pulley attached at one end, and driven by a leather or catgut cord from a grooved pulley on the electric motor. In this method, the ferrotype plate, with its first coating of wax well rubbed as directed, is held against the revolving buff and moved from side to side so that a very fine, even coating of the plate is secured. For efficiency and rapidity in coating plates, this contrivance is most useful, finishing a hundred plates in half an hour—and well worth its cost where thousands of prints must be treated in this way at a time. The Duplex Automatic Drier has a special chamber for such prints.

Fig. 7



Mounting the Prints on Plates

As many ferrotype plates having been so prepared as there are glossy prints to be dried, they are placed in a pile on their edges, ready at hand for use. A few sheets of blotting paper are laid on the mounting table, a waxed plate is laid on these, face up, and the wet, glossy print is laid face down upon the plate. By applying a very pliable rubber squeegee to the back of the print, working from the center to the edges with quick strokes and firm pressure, the print is brought into absolute contact with the ferrotype plate, all water being expelled, no air spaces or bubbles, as they are called, being permitted to form between print and plate. As fast as the prints are thus mounted to ferrotype plates in this way, they are placed face to face, one upon another, and taken to the drying closet or warm air chamber for rapid drying.

Drying Closet

This drying closet consists of a long tunnel, about 12 feet long, made of galvanized iron, and fitted with shelves or ledge pieces, angular in shape, on which slide the screens bearing the ferrotype plates, while a constant current of hot air is blown over the plates by means of a fan blower situated at one end of the tunnel, and driven by a small electric motor, receiving a supply of air from an opening over a gas stove with three or four gas rings. This ensures the rapid drying of the prints.

Drying by Heat

When thoroughly dry, the prints are peeled from the waxed plates very simply, by lifting one corner of the print and pulling it steadily away from the plate by an even, uninterrupted motion. Generally they peel off the plates by the completion of the drying process without this hand stripping being required. If successful this method gives prints with a high gloss, perfect and without blemish at any point, this perfection of gloss depending on the proper preparation of the waxed plate and the careful squeegeeing of the print upon the plate. It is all much simpler than reading about it and defective prints are very rare in every day practice.

Brown or Sepia Prints

Thus far we have been considering the production of normal black-and-white prints. It is now in order to take up the methods and formulas employed in making prints of brown or so-called sepia tones.

Triple Toning Tank

The mechanical equipment for this consists of a triple tank which will stand repeated heating, as the process calls for the prolonged use of a hot solution to effect the change of tone from black to brown. This triple tank includes (1) an inner tank made of slate, similar to those used in the silver-plating industry. This should be about 2 feet, 4 inches square (inside) and fully 6 inches deep. The sides and bottom are held together by stout screws, the holes in the slate being drilled and tapped to fit the thread of the screws. This tank is for the hot solution and should be fitted with a strong wooden lid with side strips, like a square pill-box lid, to prevent evaporation and keep the solution from dripping into the water bath surrounding it; (2) an outer tank of galvanized iron surrounding the inner slate tank, with a clearance space of 2 inches all around to serve the purpose of a hot water bath heating the toning solution in the slate tank, and (3) another outer tank or galvanized iron chamber built around the iron water tank to admit of heating the water by means of gas—this being supplied by a row of jets under the hot water tank, and connected with the house supply. The form of the triple tank is shown in Fig. 7, the front of the tank being removed in the figure in order to show the interior construction. This equipment should be fixed on a supporting stand of convenient working height, made of iron gas piping, and located near a convenient working table.

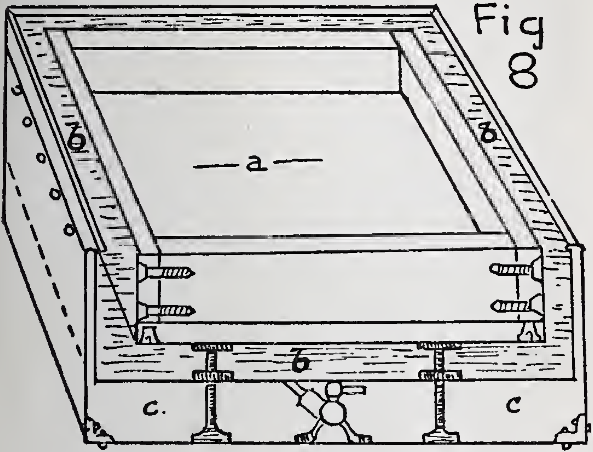


Fig 8

Hypo-Alum Solution The solution used for converting black prints to brown or sepia prints is a warm hypo-alum solution, to which a small percentage of freshly precipitated chloride of silver has been added. The effect of this addition is to ripen the hypo-alum mixture by forming hyposulphite of silver. With this the alum (an acid salt) reacts to liberate a quantity of free sulphur in a very fine state of division, which plays an important part in the conversion of the black organic silver deposit forming the picture image of the black print to a brown or sepia toned image.

The hypo-alum bath for this purpose may be made up as follows: Into a 12-gallon stoneware crock pour boiling water, 10 gallons; add hyposulphite of soda, 10 pounds, and powdered alum, 40 ounces, stirring vigorously until complete solution is obtained, after which allow the mixture to become quite cold. As a separate solution, dissolve 600 grains of nitrate of silver (crystallized) in 10 fluid ounces of water, stirring until dissolved. Now dissolve the same weight (600 grains) of common salt in 10 fluid ounces of water, and add this salt solution to the nitrate of silver solution in a 25-ounce vessel, stirring with a glass rod until a dense precipitate of chloride of silver is formed. Now add this precipitate to the hypo-alum solution previously prepared as described above.

Sepia Toning Method

For use in the toning process, about 3 gallons of this hypo-alum solution are poured into the slate tank; water is run into the surrounding iron tank and heated until the hypo-alum solution reaches a temperature of 120° Fahr., ascertained by thermometer test. This temperature must be maintained throughout the toning process.

The black prints to be toned sepia are placed in this hypo-alum solution, either wet or dry as may be, and kept in motion for a short time. After half-an-hour's immersion in this solution they will be found to have acquired a rich brown or sepia tone.

Clearing the Prints

By this time the solution will be milky in color, owing to the presence of free sulphur in the bath, and the prints will be covered with a deposit of this sulphur. As soon as they are toned to the desired color, regardless of the sulphur deposit, they are removed from the bath and placed, face up, on a clean board under a faucet supplying a gentle stream of water. Now, with a tuft of cotton, the surface of the print is wiped clean, back and front, in the running water, carefully rinsed, passed through the rubber rollers of the wringer, as before, and laid out on blotters to dry—as described for black prints.

Finishing Unmounted Prints

The majority of prints turned out by commercial studios for advertising the "movies" are made on heavy-weight development paper and delivered unmounted, this variety of paper giving prints as stiff as Bristol card and more convenient for all sorts of uses if unmounted. As soon, therefore, as they are dry, they are passed through a wringer having heavy steel rollers, the prints being placed face down upon a sheet of smooth zinc as wide as the steel rollers mentioned and the cold burnishing or finishing of the unmounted print being obtained by thus passing the print through the wringer in contact with the zinc plate. This thoroughly flattens the print and gives it a dull finish.

Formula for Paste

When quantities of large prints are to be delivered mounted on cardboard, the following method of manipulation is advised. First prepare a strongly adhesive paste as follows: Pour into the inner vessel of a large oatmeal kettle or double boiler 40 ounces water; 3 drams of formaldehyde (40 per cent), and in this dissolve 40 ounces of ordinary powdered starch and 2 ounces of wheat flour. Stir this mixture well, then place the vessel in the outer kettle and set it on a gas stove to boil. The mixture must be stirred continuously while coming to the boiling point, a wooden spoon or stave of white pine being used for this purpose. As the mixture boils, keep on stirring for a few minutes until it is seen to thicken. As soon as this takes place, remove the kettle from the fire, stirring well to secure thorough cooking and cohesion of the starch granules, and add 20 drops oil of cloves, or wintergreen, or cinnamon, which should be thoroughly incorporated with the mixture. Set aside to cool. If made at night it will be cold and ready for use the following day, after being squeezed through cheesecloth to ensure a fine, evenly mixed mass. This paste is unusually strong in adhesive power and will keep indefinitely.

Preparing for Mounting

To prepare for the mounting, clear a long table near a window, or well lighted. At one end spread a piece of clean oilcloth larger than the largest prints to be mounted. At the right place the cardboard mount, with a flat rubber squeegee or folded sheet of non-linting blotter such as Photo Finish World, of convenient size, and close at hand stack your supply of card mounts on an edge ready for comfortable use.

Mounting Large Batches

Now take from the washing tank all the prints of one size which are to be mounted, laying them face down, one at a time, over each other, in a neat pile upon the oilcloth. Twenty-five prints will be sufficient for a pile. Place two or three sheets of blotter over the pile and press out the excess of water at the sides of the pile until it is fairly dry, i. e. not running with water. Now cover the topmost print with paste, rubbing it thoroughly on over the whole of the print in quick, vigorous strokes up and down and across the width, using a fairly stiff hog's hair brush at least 2 inches wide. When the back of the print has thus been well covered with paste, remove any lumpy particles, grits, or hairs observed, using the point or tip of a knife-blade carefully to effect this, take the print by its lower left- and upper right-hand corners between the finger and thumb of each hand, let the center of the print fall until it is held in the form of the letter U from corner to corner, and gently place it on the card mount, gauging the position by a marked corner on the mount. To do this placing accurately and quickly is a matter of skill and practice. The alternative is to mark the points on the mount where the diagonal corners of the print should come, and lay the print down from its center so that the corners will fall on the points marked.

As soon as the print is placed on the mount, without wrinkle or air-space being observable, apply the squeegee at the center of the print and, by smooth, even strokes from center to edges, bring it into complete contact everywhere with the mount. If blotter is used, lay the sheet of blotter on the print and use the flat palm of the hand with a circular motion to press the print to its mount, working from the center to the edges as before. This, too, is a matter of acquired skill and dexterity. Repeat this pasting and mounting with all the prints on the pile, working cleanly and rapidly, and putting the mounted prints on flat screens to dry as fast as they are mounted.

Mounting Prints on Muslin

It often happens that a commercial studio is required to furnish a number of sets of prints, twenty-five to fifty prints per set, mounted on muslin with an extension strip at one end of the print, which forms a hinge when the prints are bound together to form an album illustrating trade articles, an industrial plant, etc. The prints used in this way are generally 8 x 10 or 10 x 12-inch size. Sometimes the prints are mounted singly; at other times they are mounted back to back on muslin, each leaf carrying two prints, and generally such orders call for glossy prints.

The best way to do this sort of mounting is to prepare the prints while in a wet state on the ferrotype or waxed plate, already described, in the following way: We have in hand an order calling for 8 x 10 prints, singly mounted on muslin. The ferrotype plates used in this case should be 10 x 12 inches in size, or larger than the prints to be mounted, for reasons which will be obvious as we go on.

Hinge Strips

First we cut a number of strips of paper of the same weight and thickness as the paper used in making the prints. These should be 1¼ inches wide and 8¼ inches in length. They are to form the hinge piece to be attached at the end of each print for the binding of the set of prints as an album. If these strips are cut from the same paper as that used to make the prints, they should be placed in the hypo fixing bath for ten minutes and afterward washed as carefully as the prints themselves. If other plain paper is used, a good, tough variety should be chosen, and the strips placed in water and blotted fairly dry just before use.

Mounting Single Prints

To proceed, the prints to be mounted are taken, one at a time, from the wash water, drained, and laid face down on the waxed ferrotype plate, as already described for drying glossy paper prints on an earlier page; the strip of paper prepared to form the hinge piece is likewise laid down on the plate at the left hand end of the print, a space of a quarter of an inch being left between the print and the hinge piece. Any drops of water which may cling to the plate are absorbed by the use of a sheet of blotter. The back of the print and the strip are now thoroughly well brushed over with the paste for which a formula has already been given. A piece of white muslin of good quality, previously cut to size a little larger than the print and its hinge piece, is now taken and laid down upon the pasted print and hinge piece, and well rubbed down so as to get perfect contact everywhere, without wrinkles or airbells. As this is done, the plate is stacked on edge to dry spontaneously, no heat being used in this instance. All the prints to be mounted are dealt with in the same way. When thoroughly dry the prints and hinge pieces, now backed by the muslin sheet, are carefully stripped from the ferrotype plates, and finally trimmed to uniform size with a sharp bench lever cutter, when they are ready for binding in any desired form.

Double Mounting on Muslin

Mounting prints on each side of a piece of muslin is not quite so simple a matter. For this sort of work a stretcher is usually employed. This consists of a wooden frame about 8 feet long and 3 feet wide, made of wooden strips 3 inches wide and ¾ inch thick, put together like the canvas stretcher used by artists who paint in oils, having triangular wooden pieces at the inner corners of the frame to permit of stretching the fabric covering by slightly enlarging the frame. A series of non-rusting nails is driven into all four sides of the frame, along the center of each strip, 3 inches apart, so that the points of the nails project evenly all around one face of the frame. A piece of muslin of good quality is now cut to a size large enough to cover the frame tightly when pulled down over the points of the nails on all four sides of the frame—like covering a drum—and the mounting base is ready for use.

The prints to be mounted are now placed ready in a neat pile, face down, on a sheet of thick glass or clean oilcloth, so that each print, when pasted, can be lifted by one corner. Alongside the prints place a similar pile of paper strips 1¼ inches wide and 8¼ inches long, prepared as already advised for single mounting.

The Method of Working

Take a large tuft of clean absorbent cotton, wet it well in running water and then squeeze in the hand so as to form a pad of convenient size holding quite a little water. Now apply this over the whole surface of the muslin on the stretcher, wiping every inch of the surface lightly to secure an even dampening all over.

Now paste the topmost print on the pile with the paste for which a formula has already been given, lay the print carefully in position on the muslin and rub it well into even contact with a small tuft of cotton, rubbing from the center of the print to its edges with a firm circular motion, as usually employed in mounting prints on cardboard. Next mount one of the hinge strips of paper at the left hand end of the print, leaving a clear ¼-inch space of muslin between print and strip to form the flexible hinge. See that the prints are all mounted one way up, viz., with their bases nearest the person doing the mounting. Proceed in this way until the whole upper side of the muslin surface is occupied by prints and strips in correct position.

Back to Back

Reverse the frame bearing the muslin and repeat the mounting, taking care that the second lot of prints are carefully placed so as to correspond exactly in position to the prints mounted on the other side of the muslin sheet. Paste the prints and strips thoroughly well and rub down with cotton as before advised. When this side has been covered with prints and strips, set the frame aside in a vertical position to dry, slightly stretching the muslin by a few taps on the angular strips at each corner—to tighten the canvas, so to speak. If this mounting is done during the afternoon or evening, the muslin and prints will be quite dry by the following morning.

Needless to say that where prints have to be mounted back to back in a predetermined order, the prints should be sorted and marked in this order. For example, fifty prints back to back for an album, to follow in a definite order. Number the prints in their order A1, A2, B1, B2 and so on. Now separate the A and B series, mounting the A series on one side and the B series on the other side of the muslin, so that A2 backs up A1, etc.

Trimming for Binding

As soon as the prints so mounted are dry, the muslin is carefully removed from the stretcher frame and the prints, with their hinge strips, are cut out and trimmed to uniform size as advised for single mounted prints. Prints so mounted and trimmed are generally sent to a bindery where backs are prepared and the albums made up according to instructions given by the photographer as to the order in which the prints are to go, the numbering of the pages, providing a title page and contents leaf, etc., as may be desired.

Sepia Prints by Direct Development Aside from the hypo-alum process for changing black development prints to brown or sepia toned prints, the process most generally in use, we have the bleaching and sulphide-toning methods, which are fully dealt with in The Photo-Miniature No. 103, and the method of producing sepia-toned prints by direct development, here to be given. Despite the disrepute which attaches to this method in the estimation of many authorities, I can vouch for the method which follows as carefully worked out and proven in practical experience.

Preliminary Note This method is generally employed with development papers coated on buff-colored stock, either rough or matt surface finish as may be desired. Note first that the warmth or richness of the brown tones obtained depends largely on a careful determination of the exposure required with any given negative and paper, and that full development is always essential to the preservation of the delicate halftones in a well-modulated print. The exposure for such prints will always be from six to ten times longer than that required for a black and white print from the same negative, and this adjustment of exposure and development to the negative and paper in use should first be determined before a large batch of prints is made.

Developer Those who prefer to make their own ammonium oxalate and ferrous oxalate instead of using the commercial articles will find the methods for preparing these on a later page. To prepare the developer required, dissolve 2 ounces of ammonium oxalate in 14 ounces of hot water; add 3 drams ferrous oxalate, 16 grains ammonium bromide, 1 dram oxalic acid (poison), and 2 grains potassium iodide. Stir well after each addition, with a glass rod, until the color of the solution is a transparent orange. Now add 6 ounces of cold water and 2 drams pure alcohol. When cold this solution is ready for use.

Exposure The exposure is most conveniently made by weak or diffused daylight, as at a window with a northerly aspect, facing the sky. It will vary, according to the negative, from six to ten times the normal exposure needed with the same light for a black development print. Ascertain the exposure by repeated test until you get the rich color desired in the print, with all the halftones.

Develop the print in the solution given above, working in a safe light, and let the development proceed until thoroughly complete, judging by the halftones and shadow detail in the print and its general color.

The Acid Bath As soon as development is completed dip the print for a moment or two only in a weak acid bath consisting of 1 fluid ounce acetic acid No. 8 in 20 fluid ounces water.

Fixing and Washing From the acid bath the print is immediately placed in the fixing bath, previously prepared as follows: Dissolve 2½ ounces hyposulphite of soda in 20 ounces of warm water and allow to get cold. Let the print remain in this fixing bath fully 5 minutes, turning it over occasionally or keeping the solution in motion to ensure complete fixation of the print. Wash in running water for 15 minutes, after which the print is laid face up on an inclined board and dried with a non-linting blotter.

Making Ammonium Oxalate Make up a saturated solution of oxalic acid (poison) in hot, distilled water. Add to this, *gradually*, powdered ammonium carbonate, stirring well, until all efflorescence ceases. Keep the solution hot, but not boiling, during this operation—about 180° Fahr. Place the solution aside for twelve hours, when half or more of the liquid will be found to be crystallized. These crystals consist of ammonium oxalate, which, when dried upon clean blotting paper, gives the salt commonly used in making up the oxalate developer.

To Prepare Ferrous Oxalate Prepare two solutions as follows. A: Dissolve 2 pounds proto sulphate of iron in 2 quarts of distilled water. B: Dissolve 1 pound of oxalic acid (poison) in 2 quarts of warm water. Filter each solution before mixing. When both salts are completely dissolved, add the acid solution B to the iron solution A; stir well with a glass strip or rod and allow the precipitate to settle for two hours. Now pour off the clear liquid, add filtered water and stir well as before. Allow to settle and then again pour off the clear liquid. Pour the residue into a strong filter paper with a wad of absorbent cotton placed over the apex of the filter, and wash this twice by pouring filtered water on the precipitated residue. Allow this to stand twelve hours, then open the filter paper upon a thick blotting board and let the mass dry spontaneously in a warm place. Reduce to powder form, when dry, by simple pressure. The result will be about 20 ounces of pure ferrous oxalate—(FeC_2O_4 $2H_2O$.

Enlargements for Display

The method of producing the large photographs used for display purposes in theatre lobbies may profitably be included here. These are usually enlarged pictures of players or scenes from plays, generally about 3 x 4 feet in size in the case of bust portraits, and 3 x 6 feet for figure poses. In the case of a bust portrait the head and face of the subject are usually enlarged to about twice life size, such pictures being placed at such a distance as to appear life size to the average passer-by.

Enlarging Easel

The enlargements from small negatives are made on bromide paper, heavy weight, which comes in rolls, 40 inches wide and 10 yards in length. The exposure board or easel may be briefly described as including a wooden framework, similar to two inverted easels joined together, fitted at the top with concave-rimmed wheels projecting at each side and arranged to run along overhead rails. These rails consist of flat strips of iron 3 inches wide and ½ inch thick, suspended vertically in metal slings from the ceiling of the enlarging room. When the double easel or frame to hold the sensitive paper is hung upon these rails, the bottom of the frame should be about 6 inches free above the floor. Any similar device will answer the purpose, an upright easel, well braced, running on rails along the floor being much used.

Camera and Light The enlarging camera is placed at such a height that the lens points to the center of the sensitive paper support just described, a long bellows camera for 8 x 10 negatives being generally employed for the purpose. The negative from which the enlargement is to be made is inserted in a plate holder having the slide or slides removed, or in a special negative carrier at the back of the camera. Immediately behind the negative is placed a light box containing either an electric arc lamp consuming from 16 to 20 amperes and giving a light equal to 3200 to 6000 c.p., or (a cheaper equipment as far as operation is concerned) a Cooper-Hewitt M tube.

Electric Arc If the electric arc is used, condensers are very desirable to secure even illumination, and a sheet of finely ground or, better, flashed opal glass will be needed to diffuse the light, this being placed between the condensers and the light source. Behind the light itself a matt-white reflector should be provided to aid in concentrating the light. The voltage required for such a light with the amperage mentioned above is but 65 or 70 volts, or for the 3200 c.p., would equal 6200 watts, the 6000 c.p. produced from the consumption of 30 amperes at 70 volts would equal 2100 watts. Since such a voltage is not supplied by the electric light companies, the usual voltage supplied of 110 or 220 must be employed, which necessitates the use of a rheostat or set of resistance coils in the circuit so as to bring the voltage down to that required for the work.

Manipulation Such an arrangement of light, camera and sensitive paper screen being provided, the methods usually employed in enlarging are followed in this work. It should not be overlooked that, as bromide paper is used here instead of development papers, the enlarging room must be suitably equipped with a "safe" light, all daylight being carefully excluded. The development of these big enlargements is carried out in a wooden tray of suitable size, constructed and varnished as described on earlier pages. The developing formula given on an earlier page for the "Hard" developer will generally be found suited to most bromide papers. If the formula given by the maker of the paper is used, it can be made up in an enameled iron pail for convenience.

Development When ready for development, the exposed paper is removed from the exposure board by rolling it in the form of a large tube. Two operators are required for the development—one holding the roll of exposed paper easily but firmly at one end of the development tray, while the other dips one end of the paper into the developer and draws the whole length of exposed paper through and under the developing solution with a quick continuous movement. He then turns, quickly strokes the sheet with the palm of the hand to aid in securing uniform development, watching the progress of development until the right depth of color has been obtained. The print is then quickly withdrawn from the developing tray directly into a second tray of acidulated water (the acid bath as given on page 388) previously prepared and placed at hand for this use.

Acid and Fixing Baths To avoid the necessity for another large tray the acid bath may be poured off the print by gently tilting this tray so that the bath runs off down a convenient sink or into a vessel, and the hypo fixing bath (prepared as on page 388) poured over the print while in the second tray. The tray is rocked to secure even fixation and after 10 minutes' fixing, the hypo solution is poured off and the print well washed in several changes of water. This is best accomplished by placing the tray so that one corner extends over the sink of the developing room, running water being supplied to the other end of the tray by means of a rubber tube.

Mounting As soon as the big prints are well washed they should be mounted before being allowed to dry. Take the print from the washing tray, drain it carefully and lay it face down on a strip of clean oilcloth spread on a bench or work-table giving room to work. Blot off the excess water with strong, non-linting blotter and paste the back of the print thoroughly, first lengthwise, then across, using the paste already described in earlier pages. While the print is in this condition, take the cardboard mount, which should be extra heavy and about ¼ inch thick, cut a piece of strong brown or manila paper to size slightly smaller than the mount, wet this, blot off excess water, paste and mount it on the reverse side of the heavy cardboard mount, rubbing it well down all over. Now turn the mount face side up on the bench, alongside the pasted print and brush this latter over once more with a thin, even coating of paste. The print is now lifted by two persons, allowing the center to drop until the print has the form of a U, place it over the mounting board and lower it carefully until it is properly placed in position on the mount. Lay one end after another down on the mount and stroke the print carefully with a 12-inch rubber squeegee, working from the center to the edges always and securing perfect contact everywhere without grit-lumps or air-bells. Finally stand the mounted print on its end in a current of air to dry. As the backing paper and the print dry at one and the same time, the print dries perfectly flat.

Finishing in B. and W. and Colors

When the prints so mounted are thoroughly dry they can be spotted or otherwise "worked-up" or "finished" in black and white by means of hand- or air-brush work. The latter is more generally used. The coloring of such prints is a separate branch of the work, too technical to be dealt with here, and demanding special skill in air-brush coloring and handling. As soon as this afterwork, whether spotting or coloring, is thoroughly dry, the prints are given two coatings of "Val Spar" varnish, the colorless variety, or the more expensive copal varnish, a broad brush being used to do this work quickly, so that the varnish is quickly laid over and not rubbed into the surface of the print. Be sure that the first coating of varnish is dry and hard before the second is applied. If may well be that the new Kodalak WP varnish is altogether suitable for this class of work, but I have not tried it in practice.

Saving Silver Waste

In every studio, commercial or other, where photography is done on a large scale, a certain percentage of development paper test strips, clippings and trimmings, developing solutions and hypo solutions are thrown out as spoilage or "waste" at the end of each day's work. It is generally known that all this photographic "waste" contains an amount of silver, but because silver has sold as low as 50 cents an ounce of late years, photographers generally have abandoned the efforts they formerly made to recover this silver lost in the daily "waste" of the studio. It was supposed to be no longer "worth while," and silver refiners ceased to haunt the professional studios in search of "wastes."

Well Worth While

Today, however, pure sheet silver for plating purposes sells at $1.20 per ounce, and the "saving" of photographic "wastes" (by which is meant the recovery of the silver from such "wastes") is again profitable. It has been estimated that the loss of silver employed in photography amounted to several thousands of dollars annually. Be this how it may, the methods of saving silver waste which follow have been adopted in one commercial studio with a saving of over $50 per week, while a large moving picture concern in New York reports that it has recovered no less than 642 ounces of metallic silver from one week's waste consisting solely of "worn-out" hypo solutions.

Worn-out or Spent Solutions

What is known as a "worn-out" hypo fixing solution simply means that the solution has lost its power to properly fix photographic prints. Such a solution is really rich in hyposulphite of silver, from which pure silver is easily recoverable. Similarly the development paper clippings and spoiled sheets are rich in silver.

To save this waste is a very simple matter after once the initial trouble of providing for the storage of the paper waste and the first step in the recovery of the waste from a large quantity of hypo solution is taken.

Paper Wastes

As to the paper wastes, these should be collected by means of a stout sack or bag, suspended in a convenient corner of the printing room. Into the sack every sensitive paper clipping, from unexposed, exposed, and developed paper should be gathered, with any spoilt sheets of paper, etc. When several sacks full of clippings have accumulated, they should be sent to a silver refiner for reduction or the recovery of the silver. Or the contents of the sacks can be reduced to ash by burning if the photographer can provide a suitable incinerator for this purpose. The fine paper ash so obtained is then sent to the refiner. A method of treating such silver paper ash for the recovery of the silver it contains is outlined in a later paragraph. (See page 413.)

Potassium Sulphide Process

For the recovery of the silver from "worn-out" or spent hypo solutions there are several methods. The old method, widely used in its day, was to pour all spent hypo solutions into a large barrel, located out-of-doors convenient to the printing room. The barrels used for this purpose should be fitted with two wooden stopcocks, without any metal parts whatever. These should be soaked in melted paraffin and inserted in the barrel above each other, the first about 12 inches from the bottom of the barrel and the second 6 inches above the first. Into this barrel, then, all the spent fixing baths are poured, instead of being thrown down the sink as usual now-a-days. A quantity of potassium sulphide (liver of sulphur) is added to the contents of the barrel. This causes the silver in the solution to be thrown down at the bottom of the barrel in the form of sulphide of silver, time being allowed for this change and subsidence.

The Residue

The depth of the precipitate or silver sulphide sludge thrown down can be ascertained at any time by turning the first or lower tap. If the liquid runs off clear, without muddy sediment, then the sludge has not yet been thrown down sufficiently and more time must be allowed. Frequently, however, the fairly clear solution must be withdrawn from the barrel by the second or topmost tap, to permit of the addition of more hypo solution. When the sludge has reached a depth of say 6 or 10 inches or so, it should be scooped out with a saucepan or similar vessel and poured into a clean canvas bag in shape like a pillow case. This is suspended over a second, smaller barrel and allowed to drain until it reaches the consistency of stiff putty, when it should be thrown out into a wooden tray to dry, collected in this dry form in convenient quantities and sent to the silver refiner, who will send you his check to the amount of silver recovered from this dried sludge. This method is thoroughly efficient for its purpose, but the process gives off a most unpleasant odor and was much disliked by those who had to work it.

A New and Better Process

The second method, which follows, is new as far as my experience goes, but has proved altogether dependable, gives no trouble or offensive odor, and ensures a larger recovery of silver than any other method I have known. In this method the precipitate is thrown down in the form of metallic silver in a very fine state of division, hence it is very valuable, bulk for bulk, when compared with the sludge or precipitate given by other methods. It is also very rapid in its action, the precipitation of a large volume of hypo solution occupying not more than twelve hours.

The Residue

In this method the spent hypo solutions are thrown into a large, clean barrel as before and a number of strips of zinc are suspended in the hypo solution from the top of the barrel; this done, all the used or discarded developing solutions of the studio are added to the contents of the barrel day by day. By this method decomposition is at once set up and the metallic silver is precipitated in the form of a fine gray mud, together with a small percentage of gelatine. The process is cleanly and involves no more trouble than simply providing a sufficient number of barrels, pouring into them the spent hypo and developing solutions day by day, stirring now and again to wash the silver sludge from the suspended strips of zinc.

How it Works

It may be surmised that the action which takes place is analogous to that of the developer upon an exposed plate or paper print, viz., the silver is reduced by the liberation of the haloid, either bromine, chlorine, or iodine in the solution, and is thrown down in a metallic state. The deposit so obtained is removed from the barrels from time to time, drained and dried as described for the first method, and sent to the silver refiner. As an approximation of the recovery possible by this method, I may state that 1½ gallons of spent hypo solution treated with spent developing solution and zinc give crude, dried precipitate = 275 grains before burning; the loss in bulk by burning is about 115 grains, leaving a net precipitate = 160 grains. This, treated with nitric acid and dried, yielded 40 grains silver chloride, equal to over 26 grains of pure silver from the 1½ gallons of hypo "waste."

Silver from Unexposed Paper Waste

Where large quantities of development paper are used daily, much of which is trimmed or cut to size before exposure, there is bound to be a fair percentage of waste strips of unexposed paper at the end of each day's work. A considerable saving of silver from such waste can be effected by thoroughly burning the strips in small lots of a few pounds at a time, and so reducing them to a fine ash. When this has accumulated, it may be sent in lots of 100 pounds to the refiners. As an example of the value of such waste, the writer recently took 16 ounces of thoroughly burned development paper ash, ground it to a fine powder and treated this with nitric acid to convert it into silver nitrate. The solution was next filtered and precipitated as silver chloride by treatment with hydrochloric acid. This gave 65 grains pure, dry silver chloride, which finally yielded 46 grains of silver. At the current price of silver this would mean a net yield of from $7.50 to $9 per 100 pounds of paper ash.

Alfred J. Jarman.

The Eyes of the Army

The airplanes at the battle front are the eyes of the army. They are blind eyes, however, if they are not equipped with cameras and lenses.

Our government will soon have ready for service thousands of observation airplanes, and we confront the fact that the camera lenses needed for these airplanes cannot be bought in the usual way of business. They are not in the markets. We are unable at present even to manufacture the special kind of optical glass indispensable to the making of the lenses required for this work. This glass cannot be bought in America today.

The lenses required by the government are all makes of anastigmats having a working aperture of F: 3.5 and F: 4.5, with a focal length of from 8¼ to 24 inches, such as Carl Zeiss Tessars, Bausch & Lomb Tessars, Voigtlander Heliar, Euryplan, Goerz, Cooke, Moia, Busch, Steinheil, Ross, Ross-Zeiss, Krauss, Krauss-Zeiss and Beck.

There are thousands of these lenses owned and used in this country by process engravers, commercial, professional and amateur photographers. In this urgent emergency our government appeals to those who have these lenses to sell them to the government for use in the airplane service.

The need is imperative. Every photographer who possesses an anastigmat of the sort described must realize that it is his privilege and patriotic duty to offer it to the government without delay. If you have such a lens, send a detailed description of it today, naming the price at which you will sell it, to the Photographic Division, Signal Corps, U. S. A., 825 Mills Building Annex, Washington, D. C.

Notes and Comment

I have been remiss in not earlier recording the fact that Charles L. Abel, son of Juan C. Abel, and editor of "The Amateur Photographer's Weekly," of Cleveland, is "doing his bit" to help win the war as a lieutenant in the U. S. Reserve Corps. Dr. Francis L. Chambers, son of Frank V. Chambers, of "The Camera," has left a lucrative practice to serve his country as a lieutenant in the U. S. Medical Reserve Corps. Eduard J. Steichen, with a big record in pictorial photography behind him, is a lieutenant in the Photographic Division of the U. S. Signal Service Corps, and Roger B. Whitman, of New York, as skilled a specialist in architectural and commercial photography as we have in America, is also a lieutenant in the same branch of the service. All honor to them.

The death is announced of Sir William Herschel at the advanced age of eighty-four years. Sir William, who died at Warfield, England, on October 24, was the eldest son of Sir John Herschel, the famous astronomer and chemist who played an important part in the beginnings of photography.

THE HARVEY EXPOSURE METER NO. 2. I would like to add my word to the many praises given to Harvey's Exposure Meter. Most of these were given to the meter first introduced over a year ago. My experience has been with the No. 2 meter, which embodies all that Harvey himself learned from a year's constant use and checking of the first meter. Passing over the fact that it is not a meter, in the proper sense, since it does not attempt to measure the exposure by actinic test, but is really an exposure calculator giving the required exposure period by the calculation of factors, let me say that it is not only the simplest and most accurate exposure calculator I have ever used, but it represents a definite advance over all similar instruments in its completeness and in the variety of conditions covered.

No attempt will be made to describe it here, since to do that adequately would fill several pages, but the reader who has experienced difficulties in estimating exposures (and who has not?) is simply urged to write George L. Harvey, 105 South Dearborn Street, Chicago, Ill., mentioning this note, and ask for full particulars of Meter No. 2.

The meter itself is made of celluloid, fits the waistcoat pocket and costs but $1.25. I can promise that it will give a grasp of the exposure problem worth ten times its cost, and that its use will enable the average amateur to cut his exposure failure expense at least fifty per cent. It is extremely simple in use, the movement of only two scales showing simultaneously the exposure required for eight classes of subjects with all lens apertures from *f*/4.5 to *f*/32, and it does all that it claims to do. It is adapted for use with every known type of camera, and the exposures are given for the U. S., *f*/ system and Kodak stops.

Kodalak WP is a fine, transparent lacquer just introduced by the Eastman Kodak Co. for waterproofing prints. There has long been a demand for such a preparation, and every photographic shelf should have its bottle of Kodalak WP ready for use.

A new process for producing photographs in color on paper has been introduced by J. M. Hanmond, of Philadelphia. It is said to be simple in operation, applicable to life and still subjects, the copying of paintings, etc., and the results are, it is claimed, an improvement on anything of the sort previously seen. An exhibition of prints by the new method was recently given before the Photographic Society of Philadelphia.

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Modern Photographic Developers

The disappearance of so many of the photographic developers with whose names and characteristics we have long been familiar, and the appearance of so many "new" developers of unknown origin and composition, under strange and uncouth names, naturally brings forward the questions: What are these new developers made of? Where do they come from? How do they compare in capacity and use with the developers they replace? and the like. These questions have burdened my correspondence for many months past, and some of them have been difficult to answer in a letter of reasonable length. Facing this situation, I determined to devote a whole number of The Photo-Miniature to the subject, hoping thus to provide, as Maimonides did so long ago, a "Guide to the Perplexed" and, at the same time, ease my own troubles. Thereupon I first sought the aid of a chemist with experience in this special branch of chemistry, and second, I set out upon an investigation of the American developer industry for whatever that adventure might bring forth. The result will be found in the monograph following, which gathers together all the information at present gettable about modern photographic developers. Mr. Wein, well equipped for his task, has marshaled the available facts concerning his subjects in an interesting way, and presents them in the simplest and clearest form possible where so many delicate chemical and technical processes are involved. Further, be it noted, I have exercised my editorial privilege liberally, taking prodigious liberties with Mr. Wein's monograph where this seemed necessary or desirable in the reader's interest.

If it should seem to the reader that there is not, after all, much that is new about the "new" developers, let the gentle reader comfort and content himself with the assurance, here frankly given, that his surmise is correct. That much, with some other pertinent facts, I discovered in the personal investigation to which I have referred. At first I was puzzled by the evident reluctance of the makers of the "new" developers to give any definite, commonsense information about the actual composition of their products. It seemed to be impossible to get behind the fanciful trade names and ascertain the chemical composition of the products offered as subsitute developers. This strange abuse of the art of *camouflage* is, I am glad to say, being abandoned, and the "new" developers are being sold under their true and rightful names. As one result of this, it is now seen that our American and British chemists are not inventing or evolving new chemical compounds to replace those so long imported from Germany, but are simply doing their best to reproduce them commercially —a new sort of Declaration of Independence.

—EDITOR.

A Developer Defined

What do we mean when we speak of a photographic developer? In general usage the term indicates the chemical solution used to bring out—"develop" or make visible—the latent but invisible picture image which we know results from the action of light on a dry plate, film, or development or bromide paper, exposed behind the lens in a camera, or behind a negative in a printing frame or enlarger. In these pages, however, the word developer primarily means the active chemical compound, or developing agent proper, which forms the base of the developing solution, and which gives it its developing power or capacity.

Developing Power: Reduction

The light sensitive film with which our plates, films, and printing papers are coated consists of gelatine emulsion in which silver haloids, e. g. silver bromide or chloride, in an extremely fine state of division, are very evenly distributed. We do not know the precise nature of the change or alteration effected by the action of light in this sensitive film during exposure. But we do know that certain chemical compounds, which are easily oxidized, have a preferential action on the silver haloids, reducing to metallic silver those on which light has acted and having little or no action on those not so acted upon by light. This we call developing power since it makes the form and details of the picture image visible to the eye. Thus, by development, which is here seen to be a process of chemical reduction, we get, in the case of a dry plate or film exposed in the camera, a negative picture image on glass or transparent film; and, in the case of printing papers exposed behind a negative, a positive picture image on paper. In this process the developer is the active reducing agent, the other ingredients of the developing solution doing other and different work.

Where the Developers Come From

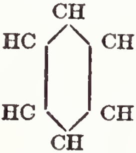
Most of the compounds which have been found to possess this preferential action as to silver haloids, or power to reduce silver bromide or chloride to metallic silver, are derivatives or substitution products of benzene or naphthalene. As these are known as "organic compounds," so the developers obtained from them are called organic developers, and the chemistry of development is an interesting branch of organic chemistry. Without venturing too far into this world of wonders, we can get a fairly clear notion of the origin and source of our modern developers by a little study of benzene and some of its derivatives, which we will now proceed to do.

Benzene

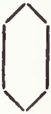
Benzene, the venerable parent of almost all the developers used in photoggraphy during the last fifty years, and of great importance in the making of dye stuffs and pharmaceutical preparations, was discovered by Faraday in 1825, and is commercially manufactured from coal-tar distillate. To the chemist it is known as $C_6 H_6$, which simply expresses the fact that the benzene molecule consists of six groups of atoms, each of these groups containing one atom of carbon (C) and one atom of hydrogen (H).

Kekule's Hexagon

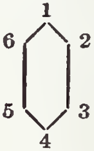
In 1866, Kekulé published the fact that benzene behaves in its reactions with other bodies as though the carbon atoms were linked together round the points or angles of a hexagon, each with a hydrogen atom attached to it. This gives us the famous Kekulé hexagon formula for benzene, sometimes called the benzene ring. For clearness in what follows, we will show this graphically: (1) In full; (2) as generally abbreviated in use, the C and H atoms being supposed to be at each angle, except where the substitution of other atoms or groups is shown by the introduction of a new symbol; and (3) with the points numbered to show in which position any addition or substitution is made, this being of importance, as we shall see later.



(1)



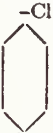
(2)



(3)

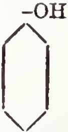
Derivatives: Phenol: Aniline

Thus far the simple but fascinating benzene molecule. Now let us see how the derivatives or substitution products are obtained. The hydrogen (H) atoms in benzene are easily replaceable by other atoms or chemical groups as, for instance, chlorine (Cl), hydroxyl (OH), or amido (NH_2) groups. Thus we get:



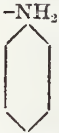
Chlor-benzene

(4)



Hydroxy-benzene or Phenol (Carbolic Acid)

(5)



Amido-benzene or Aniline

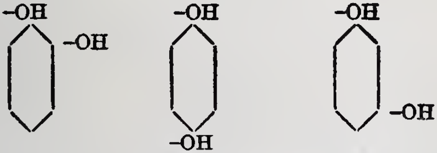
(6)

Significance of Group Relations

None of these compounds has any developing power. If, however, we replace the two hydrogen atoms in two of the CH groups by two hydroxyl (OH) groups, or by two amido (NH_2) groups, or by one hydroxyl and one amido group, we may or may not get compounds (derivatives or substitution products) possessing developing power. Whether we do or not depends upon the position of the second substituted hydroxyl or amido group in relation to the first. See Fig. 3 at this point. When the replacement or substitution (or introduction of atoms or groups) takes place in adjacent CH groups, we get what is known as an *ortho* compound or derivative. If the replacement takes place at opposite corners we get what is known as a *para* derivative. But if the replacement takes place at neither adjacent nor opposite points, but always with one CH group between, the result is known as a *meta* compound. The significance of the relations between the substituted groups in these changes lies in the fact that the *ortho* and *para* compounds have developing power and so give us developers, while the *meta* compounds lack this power.

Catechol Quinol Resorcin

For example, if we take the benzene molecule (Fig. 1) and replace the two hydrogen (H) atoms at 1 and 2, at 1 and 4, and at 1 and 3 (Fig. 3) by hydroxyl (OH), we get three *bi*-substitution hydroxybenzene derivatives thus:

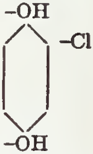


(7) Ortho- (8) Para- (9) Meta-
hydroxy-benzene

Of these (7) is catechol, which we know as the energetic developer pyrocatechin; (8) is quinol, or hydroquinone; and (9) is resorcin which has little or no developing power. They all have the same chemical formula $C_6H_4(OH)_2$, i. e. the same chemical composition, but differ in *constitution*, and their usefulness as developers is seen to depend on the position of the substitution groups. It may be added that the *para* compounds are usually more powerful or more energetic as developers than the *ortho* compounds.

Adurol

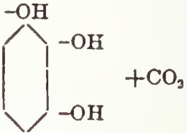
Pursuing the substitution idea further, Hauff replaced the hydrogen atom (H) in the second position (Fig. 3) in hydroquinone (Fig. 8) by chlorine (Cl), thus: with the formula $C_6H_3Cl(OH)_2$, a halogen substitution product, mono-chlor-hydroquinone to which he gave the name Adurol-Hauff. Schering introduced or substituted bromine in the same way, obtaining mono-bromo-hydroquinone with the formula $C_6H_3Br(OH)_2$, these modifications being said to give adurol definite advantages as compared with hydroquinone as a developer, the mono-chlor compound being preferable to the mono-brom product.



(10) Adurol

Di- and Tri-oxy-Phenols

Pyrocatechin, hydroquinone and adurol are grouped together as bi-oxy-benzenes. Pyro, which has been used as a developer since 1851, is a tri-oxy-benzene, the hydrogen (H) atoms in positions 1:2:3 (Fig. 3) being replaced by three hydroxyl groups thus:



(11) Pyro

which shows how closely related it is to hydroquinone and pyrocatechin.

Amido and Other Groups

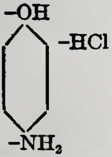
What has been said of the substitution or introduction of two hydroxyl (OH) groups in obtaining di-hydroxy-benzene derivatives, holds good in the use of two amido (NH_2) groups, which gives us a similar series of ortho, para, and meta di-amido benzenes (diamidophenols). Similarly, we may substitute one hydroxyl and one amido group, this giving amido-hydroxy-benzenes (or amidophenols), and these substitutions may be further extended. Thus, in the amido (NH_2) group one of the hydrogen (H) atoms may be replaced by a methyl group, viz. CH_3.

Para-amido-phenol Diamidophenol

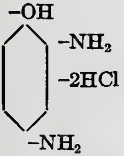
For example, if we take phenol (Fig. 5) and introduce an amido (NH_2) group in place of a hydroxyl (OH) group, we get para-amido-phenol (Fig. 12) which is the base of most of our "new" American developers, and was formerly sold in concentrated form as Rodinal, Unal, Citol, etc. The introduction of a second amido (NH_2) group gives us diamidophenol (amidol) as shown in Fig. 13.

Metol, Glycin, Ortol

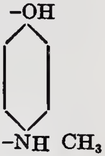
Metol is obtained by the introduction of a methyl (CH_3) group as in Fig. 14 and is a *para* derivative of amidophenol, according to Andresen and Hauff, although Schweitzer, a few years ago, speaking apparently from information obtained from its originators, states it to be the sulphuric acid salt of monomethyl-paramido-metacresol, which is, so to speak, "a horse of another color." As matter of fact, its chemical constitution has never been divulged.



(12) Paramidophenol

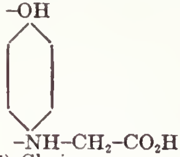


(13) Diamidophenol or Amidol

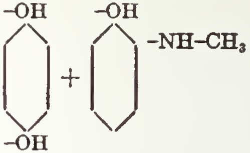


(14) Metol (base)

Glycin, essentially, is metol with the methyl radicle replaced by acetyl (CH COOH), this giving para-oxy-phenyl-acetic acid, with the formula C_6H_4 OH. $NHCH_2$ CO_2H shown in Fig. 15. Ortol is said to be a compound of one molecule of hydroquinone and two molecules of methyl-*ortho*-amidophenol sulphate (similar to the para form—metol), being a patented mixture, probably as seen in Fig. 16



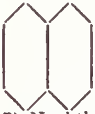
(15) Glycin



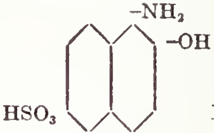
(16) Ortol

Naphthalene Group: Eikonogen Diogen, etc.

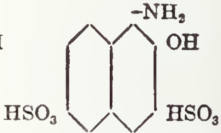
It is characteristic of the benzene groups that they readily link themselves together, giving compounds of great complexity from which other derivatives useful as developers may be obtained. Thus, by linking two benzene rings, as seen in Fig. 17, we get naphthol ($C_{10}H_8$) from which eikonogen (Fig. 18) and diogen (Fig. 19) are derived.



(17) Naphthol

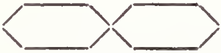


(18) Eikonogen

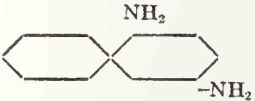


(19) Diogen

Or we may imagine the two rings linked as in Fig. 20, representing the compound diphenyl ($C_{12}H_{10}$), from which the Agfa developer Diphenal is obtained, as seen in Fig. 21.



(20) Diyhenyl



(21) Diphenal

What We Have Learned

This graphic survey of the substitution possibilities of the benzene compound may well suffice to give us a practical notion of the origin of some of our modern developers. As we know, most of them were patented products imported from Germany, and, as our chemists are finding out, generally differed in actual composition or constitution from what was set forth concerning them in formulas and patent specifications. In the attempts made by American and British chemists to reproduce them, one may sum up present results by saying that the British product Metol-Johnsons and the American Methylol very closely approach German Metol in chemical composition and the results they give. Paramidophenol, in many forms and all manner of disguises, and hydroquinone of excellent quality are being regularly manufactured here and in England. Azol is the name of a British-made Rodinal, said to be identical with the German product. And we are assured of American- and British-made amidol (diamidophenol) fully equal to the French and German makes so long used on both sides of the Atlantic. With which we may now turn our attention to the developers in detail.

Pyro

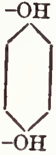
Of pyro I propose to say little or nothing here. It has its place among modern developers only because it is still the most widely used and the most useful of all photographic developers. Properly known and intelligently handled, it will do all that any other developer will do, excepting only the development of bromide and gaslight papers, wherein the more modern, stainless developers, such as amidol are preferable. But to explain the advantages of pyro would fill a book bigger than this. Some day we may devote a whole issue of THE PHOTO-MINIATURE to it and so do it justice.

Characteristics

Chemically, pyro—otherwise pyrogallol or pyrogallic acid—is $C_6H_3\ (OH_3)$, a tri-oxy-benzene, as seen in Fig. 11, page 422. It comes in fine, white, feathery crystals, bulky and difficult to handle (resublimed), and in heavy crystals, which form is altogether preferable. It is readily soluble in cold water, and concentrated solutions can be prepared with sodium sulphite. It is extremely sensitive to potassium bromide, which should be used sparingly. It oxidizes very quickly in use or exposed to the air; but combined with an acid gives a clear solution, which will remain colorless for months if kept in well-filled, stoppered bottles.

In Use Photographically, pyro is the most ancient of developers, dating away back to 1851 in Scott Archer's wet-plate process, and to Major Russell (1862) as an alkaline developer. It is also the most modern because it is used today by the majority of professional workers all the world over, and it is the best developer for tank development of films, in combination with metol or other of the detail-giving compounds. It surpasses all other developers in flexibility and the control it offers over the printing quality (density and color) of the negative. Unless used with more than average care and caution it stains the hands abominably. It combines well with metol, glycin and rodinal or their other-named equivalents. A pyro developer can be used but once, after which it must be discarded; in spite of which pyro is the most economical of all developers. I do not give any formulas for the use of pyro, alone or in combination. Their name is legion. You will find them in every box of plates and package of films, and they vary according to the use and the character of the plate or film with which they are to be used.

Hydroquinone



With the single exception of pyro, to which it is closely allied, hydroquinone, otherwise named hydrochinone or quinol, is probably the most largely used of modern developers. It was introduced by Abney in 1880, and is a di-oxy derivative of benzene, two hydroxyl groups (OH_2) being substituted for the hydrogen atoms in the *para* position in the benzene ring, as shown in the margin. To the chemist it is para-dioxy-benzene, $C_6H_4\ (OH)_2$. Its purity and quality are indicated by its color; when chemically pure it comes in snow-white, fine, needle-like formation. It is sparingly soluble in cold water (5 per cent), but freely soluble in warm water or alcohol.

Commercially, hydroquinone is prepared by oxidizing aniline with potassium or sodium bichromate and sulphuric acid, which gives a yellow, crystalline precipitate (quinone). This is dissolved in water and a stream of sulphur dioxide is passed through the solution until it smells of sulphurous acid. The suspended matter in the solution is now filtered off, and the hydroquinone extracted from the filtrate by means of ether, which is subsequently distilled off, leaving the hydroquinone in its characteristic form. Until recently almost all the hydroquinone used in America and Britain was manufactured in Germany, but it is now produced by several firms in America equal to the highest European pre-war standards, e.g. Gennert's Gold Label hydroquinone.

Characteristic Capacity

In today's practice hydroquinone is generally employed in combination with other developers, being seldom used alone, e. g. as pyro is commonly used, except in copying and lantern-slide work, wherein its characteristic capacity for giving great density, with clear shadows and brilliancy of gradation is of obvious advantage.

Comparisons

Compared with pyro, hydroquinone keeps better in solution, does not stain the fingers in use, and gives negatives of a blue-black color similar to that obtained with ferrous-oxalate. In comparison with metol and rodinal, it is a slow-acting, "hard" working developer, yielding "snappy" negatives with strong contrasts.

Influence of Temperature

Hydroquinone has the disadvantage of being very susceptible to variations of temperature. At a low temperature it is apt to crystallize out in its solutions, which either brings development to a standstill or slows down its action; in any event cold hydroquinone developing solutions mean loss of detail and density in the negative. Advantage may be taken of this by the use of cooled solutions for the development of negatives known to be grossly over-exposed. Normally it is advised to keep a hydroquinone developing solution at a temperature of 65° Fahr. In cold weather this may be raised to 70°. Increase in temperature, however, tends to excessive density and fog, this tendency varying according to the character of the plate in use.

How Used

Used alone, hydroquinone is generally made up with potassium or sodium carbonate, and these carbonate alkalies are advised, although the use of a caustic alkali gives greater rapidity and softer contrasts. Sodium sulphite has a marked influence in hydroquinone development; the greater the proportion of sulphite employed in a given formula, the stronger will be the contrasts in the negative. Potassium bromide acts as a powerful restrainer with hydroquinone, and is therefore sparingly used, e. g. 3 to 5 drops of a 10 per cent solution in 4 ounces of developer for normal exposures; 10 to 30 drops in cases of overexposure or with soft working plates. Citric acid and yellow prussiate of potash are alternate restrainers.

Single-Solution Formula

A satisfactory single-solution hydroquinone developer may be made up as follows: Water (hot), 15 ounces; hydroquinone, ½ ounce; sodium sulphite (cryst.), 4 ounces; potassium carbonate, 6 ounces; potassium bromide, 18 grains. Dilute with from 4 to 6 times its bulk of water for normal use.

Two-Solution Formula

Cramer's two-solution developer is as follows: No. 1—Distilled water (hot), 25 ounces; sodium sulphite (cryst.) 3 ounces; hydroquinone (Hauff), ½ ounce; potassium bromide, ¼ ounce. No. 2—Water, 25 ounces; sodium carbonate (cryst.), 6 ounces. For use, take equal parts of No. 1 and No. 2 at 65° Fahr.

For Lantern Slides

A typical two-solution formula for lantern slide plates is as follows: No. 1—Water (hot), 20 ounces; hydroquinone, 150 grains; potass. metabisulphite, 10 grains; potass. bromide, 50 grains. No. 2—Water, 20 ounces; sodium sulphite (cryst.), 2 ounces; sodium hydrate, 100 grains. For use take equal parts No. 1 and No. 2.

In Copying

For copies of line drawings, sketches, maps, etc., where extreme density combined with clear lines is required, the following formula will be found reliable: No. 1—Water (hot), 20 ounces; hydroquinone, 160 grains; sodium sulphite (cryst.), 4 ounces; citric acid, 60 grains; potass. bromide, 160 grains. No. 2—Water, 20 ounces; potass. hydrate, 320 grains. For use take equal parts of No. 1 and No. 2, or, where overexposure is indicated, 2 parts No. 1 to 1 part No. 2.

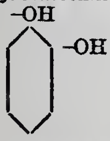
When Stains Come

Although commonly described as a stainless developer, an oxidized or stale hydroquinone solution will produce yellow stains, as in the prolonged forcing of an underexposed negative in development (wherein hydroquinone should not be used.). This stain rarely yields to ordinary "clearing" agents, but may be removed by the skilful use of Farmer's Reducer, the process of stain-removal being carefully watched so that the density of the negative is not affected.

Combined with Other Developers

Thus far we have considered the use of hydroquinone alone as a developer, in which use its characteristics are most clearly exhibited. By far its largest use, however, is in combination with other developers, such as metol, paramidophenol, edinol, rodinal, etc. Its action in all these combinations seems to be to add vigor and density-giving power. Formulas for such combinations are given in the consideration of the respective developers mentioned.

Pyrocatechin



Identical in chemical composition with hydroquinone, but differing from it in constitution, in that the two dioxy groups $(OH)_2$ are substituted for the hydrogen atoms in the *ortho* position in the benzene ring, we have pyrocatechin or catechol. This is known to chemists as ortho-dioxy-benzene, C_6H_4 $(OH)_2$ and comes in prismatic colorless crystals, freely soluble in water and alcohol.

History: Variations

The use of alkaline solutions of pyrocatechin for development was observed by Eder and Toth in 1880, but it comes within our survey of modern developers because of its re-introduction in 1898, in modified forms, known as Elconal, Elconal F and Kachin. These seem to have disappeared from the market, but pyrocatechin is still listed by a few chemists.

Compared with Hydroquinone

In action pyrocatechin is said to be more energetic than hydroquinone, but otherwise very similar except that it is not so markedly influenced by ordinary variations of temperature and has no tendency to fog. It is made up with either carbonate or caustic alkalies.

A Formula A reliable formula is as follows: No. 1—Water, 10 ounces; pyrocatechin, 80 grains. No. 2—Water, 10 ounces; tribasic sodium phosphate, 1 ounce; sodium sulphite (cryst.), 3 drams. For normal exposures take one part each of No. 1 and No. 2 and add one part water. (For a more vigorous, quick-working developer for normal exposures, increase the sodium salt in No. 2 by from 50 to 100 per cent.) For slight overexposure, take 2 parts No. 1, 1 part No. 2; for marked overexposure add to the above one-tenth part of 10 per cent potass. bromide solution. For underexposure, take 1 part No. 1, 2 parts No. 2 and add 3 parts of water, following, if necessary, by more of No. 1 to gain density. The restraining power of potass. bromide is small when carbonate alkalies are used, but increases when caustic alkalies or the tribasic sodium salt is employed.

Elconal F: Kachin Pyrocatechin is the only developer which retains its normal developing power in the presence of "hypo," hence, in its modified forms of Elconal F and Kachin it was exploited for simultaneous development and fixing, but general experience failed to support the claims made for it in this particular.

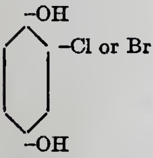
The most extravagant claims were made in behalf of Kachin as a developer when it was introduced in Britain, many experimentors averring that it possessed all the virtues and none of the defects of other developers, but it seems to have vanished so far from human ken that it is no longer "formularized" in the "B. J. Almanac," wherein it held place from 1899 to 1916.

Metoquinone Quinomet A chemical combination of metol (base) and hydroquinone $(C_6H_4 OHNH)(CH_3)_2 + C_6H_4 (OH)_2$, introduced by Lumière in 1903 as an energetic developer used with or without an alkali. Sold in Britain as Quinomet. It is a fine, white powder, sparingly soluble in cold water, but freely soluble in hot water. A typical formula for time exposures is: Water (hot), 20 ounces; metoquinone, 86 grains; sodium sulphite (cryst.), 2½ ounces.

Dissolve the ingredients in the order named. For the development of instantaneous exposures, add acetone, 1¼ ounces, or one-third this quantity of sodium tribasic phosphate, or one-sixth the quantity of caustic lithia. This is Lumière's formula.

Pyramidol This, a condensation product of hydroquinone and paramidophenol, introduced by Hauberrisser a few years ago, is not now in the market. It had the formula $C_6H_4OHNH—C_6H_4\ (OH_2)\ H_2SO_4$. In use it resembled paramidophenol, but offered special advantages for the correction of gross overexposure by its behavior with potassium bromide, yielding good negatives in overexposure ranging from sixteen to forty times normal.

Adurol



In the brief survey of the origins of our modern developers already made, the reader has observed the changes or modifications in developing properties effected by the introduction or substitution of such groups as OH and NH_2 in various developer nuclei. The formation of para-dioxy-benzene or hydroquinone, seen in Fig. 8, page 421, is an illustration of such a change. In 1898 Hauff and Lüppe Cramer independently investigated the possibilities of modifying hydroquinone by substituting a halogen (chlorine, bromine, etc.) for one of the hydrogen atoms in the hydroquinone nucleus. Their investigation resulted in the commercial introduction (1899) of two halogen derivatives of hydroquinone, both of which we know as the developer Adurol. As made by Hauff, Adurol is monochlor-hydroquinone, $C_6H_3(OH)_2Cl$; as made by Schering it is monobrom-hydroquinone, $C_6H_3(OH)_2Br$. They are identical in general characteristics and behavior, although Lumière and Seyewetz, in a later investigation (1914), found that the monobrom product was more energetic than the monochlor form.

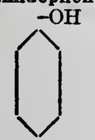
How Made Commercially Adurol is made by passing bromine or chlorine into a solution of hydroquinone in benzene and evaporating to crystallization. It comes as a white, crystalline powder, readily soluble in water.

Compared with Hydroquinone The practical purpose of Hauff's and Cramer's investigation was, of course, to improve hydroquinone by the elimination of its well-known disadvantages. This they accomplished. In its developing power Adurol stands between hydroquinone and metol, and it is equally useful for negative, lantern slide and print development. It has better keeping quality in solution than hydroquinone, and is hardly influenced at all by changes in temperature. It gives greater density than hydroquinone, even without caustic alkalies, and is less inclined to harsh contrasts or hardness. Its solutions do not discolor, hence the Adurol developer is stainless as to plates, films, papers, and fingers. In development, as compared with hydroquinone, Adurol is more energetic in action, yields softer negatives, and can be used repeatedly. It gives a blue-black image and is therefore very suitable for the development of development and bromide papers.

Lack of Appreciation With all these improvements over hydroquinone, verified by authority and experience, it is not easy to understand why Adurol has not long ago displaced hydroquinone in photographic practice. The fact remains that it has not interfered, to any degree worth mentioning, with the steadily increasing popularity and use of hydroquinone and metol.

Formulas Typical formulas are given as follows: For plates and films, Two-Solution Developer: No. 1—Water, 10 ounces; sodium sulphite (cryst.), 1¾ ounces; Adurol, 85 grains. No. 2—Water, 10 ounces; potassium carbonate (cryst.), 1¾ or 2 ounces. For normal outdoor exposures take equal parts Nos. 1 and 2; for known overexposure take 1 part each Nos. 1 and 2 and 1 part water; for portraiture take 3 parts No. 1 and 2 parts No. 2. As a concentrated single solution developer, the following is advised: Water, 10 ounces; sodium sulphite (cryst.), 4 ounces; potassium carbonate, 3 ounces. Dissolve thoroughly by heat, allow to cool, and add Adurol, ½ ounce. For portraits or subjects with detail, take 1 part of this to 3 parts of water. Adurol is very sensitive to the restraining power of potassium bromide, the use of which slows development and tends to excessive density. Nevertheless, a 10 per cent solution of potass. bromide is to be used when fog is feared, rarely more than 2 drops per ounce of developing solution.

Paramidophenol



Of all the photographic developers introduced during the past thirty years, paramidophenol may fairly be said to be at once the most important and the most widely used, although comparatively little known under its own name. It was first used, photographically, by Andresen in 1888, and has been commercially exploited by world-wide advertising, in many forms under different trade names, since 1891.

Chemical Composition

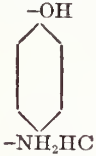
As its formula $C_6H_4OHNH_2$ shows, paramidophenol differs in chemical composition from hydroquinone only in the fact that one of the OH groups is replaced by an NH_2 group. Compare the figures 8 and 12 on pages 421 and 423. This difference, the conjunction of an hydroxyl group and an amido group in the para relation, results in a compound which, in its various salts and combinations, possesses remarkable developing properties. As we will see, paramidophenol is the foundation of many of the patented developers with fancy names, which formerly came to us from Germany, as well as of most of the "new" developers with even more fanciful names, now being manufactured in America and Britain.

Commerical Preparation

Commercially, paramidophenol is a phenol compound, prepared by adding nitric acid to phenol, when an oil separates, which is a compound of ortho- and paranitrophenol. This is subjected to steam, when the volatile ortho-nitrophenol (used in making the developer sold as Ortol) distills over, leaving the non-volatile para-nitrophenol as a residue, which is reduced to paramidophenol by treatment with hydrogen. In this form, paramidophenol (free base), with sodium sulphite alone, has some developing power, but is so sparingly soluble in water as to be of little practical use as a developer. It has, however, distinctive properties

(e. g. it can act in a weak way, both as a base and an acid), which make it extremely useful as a base for the preparation of other compounds, salts, etc., more freely soluble and more powerful as developers.

Paramidophenol-hydrochloride



As a base paramidophenol readily combines with strong acids, such as hydrochloric and sulphuric acids. With the first it forms paramidophenol-hydrochloride, $C_6H_4OHNH_2HCl$. This is the salt most generally obtainable commercially, and that usually intended in formulas where "paramidophenol" is mentioned without further specification. It comes in fine, prism-like crystals, more or less white, according to the purity of the product. A good sample should contain 75 per cent or more of paramidophenol. The hydrochloride salt is said to possess 20 per cent more developing power than the sulphate, and is sold under its own name, as well as under various trade names, as Kodelon, etc.

Test for Purity

Generally speaking, the purity and quality of a sample of paramidophenol-hydrochloride is assured, if purchased from a responsible maker or dealer. The following test, for which I am indebted to Mr. L. H. Wallace, is simple and efficient for its purpose. Add 10 grains paramidophenol-hydrochloride to 1 ounce distilled water in a clean glass vessel. If the sample is pure, it will dissolve readily and give a clear, colorless solution which will remain clear for several hours. If when first prepared the solution shows a purplish, yellowish, or greenish color, this denotes the presence of dyestuff; if particles of insoluble matter remain in suspension in the solution, this indicates the presence of organic impurities; both are detrimental to the keeping and developing power of the sample, in proportion to the showing on test.

Solubility-Keeping Qualities

Paramidophenol-hydrochloride is readily soluble in water (1:10) but keeps better in fairly strong solutions than in diluted solutions. Dissolved in 5 or 10 per cent sodium sulphite solution it will keep clear and retain its characteristic qualities for days. When made up in developing solutions where the sodium carbonate predominates, pure paramidophenol-hydrochloride has excellent keeping quality. If the salt is impure, however, it will be necessary to have the sodium sulphite in excess, which, however, is detrimental to the developing power of the solution.

Notable Peculiarities

As paramidophenol developers are generally compared (as to their practical efficiency) with the familiar (German-made) metol developer, it is important to note here two peculiarities of paramidophenol which materially influence any comparison of the two developers in use.

"Slowing up" "Speeding up"

First: When paramidophenol is dissolved in sodium sulphite, or sulphite and potassium or sodium carbonate solutions, there results a formation of the true paramidophenol base in the solution. This robs the solution of its developing power in some degree, so that such developers are said to "slow up" or "run down" more quickly than metol developers. It is not so in fact, as the apparently exhausted developing solution can be speeded up by the addition of small quantities of sodium hydrate (caustic soda). This redissolves the paramidophenol base first precipitated and makes it effective again for development. A saturated solution of sodium hydrate can be kept on hand and conveniently used for this purpose as needed, just as we use a 10 per cent solution of potassium bromide for restraining development. With this addition of caustic soda as needed, it will be found that paramidophenol (hydrochloride or sulphate salt) approximates metol in developing power and efficiency.

Sensitive to Potass. Brom.

Second: It is often advised to use paramidophenol "the same as metol," i.e. replacing the amount of metol called for in any formula by an equal amount of paramidophenol salt. This is radically wrong. Where the makers give a definite formula, follow the formula as to the amount of paramidophenol required. Further, paramidophenol, unlike metol, is extremely sensitive to the restraining and retarding action of potassium bromide, and this should, therefore, be used with intelligent caution in connection with paramidophenol developers. In many formulas using metol, the amount of potassium bromide equals the amount of metol. With paramidophenol the proportion should rarely exceed 1 part of potassium bromide to 10 parts of paramidophenol. Generally a less quantity of bromide can be used to advantage. Always, if the paramidophenol is pure, the proportions given will be sufficient to clear the whites.

As to Sodas

It should also be noted that to secure the largest efficiency of results with paramidophenol salts, the quality and uniformity of the sodas used is important. There is so much confusion here in commercial brands that the only right way is to use those specifically mentioned in the formula employed, or to select a reliable brand and use that brand uniformly and exclusively.

Getting Density

Finally, we come to the complaint that many fail to get sufficient density with paramidophenol to give good printing negatives. This is generally due to the fact that, with paramidophenol, as with metol and amidol, the image appears rapidly but gains density slowly. Also a little density is lost in fixing. The remedy is obvious. Carry development a little further than seems necessary by the usual visual test, in order to make sure of a negative of sufficient density to yield good gradations in your prints.

Formulas

When paramidophenol-hydrochloride was first introduced as a negative developer, it was used alone, with sulphite only or with sulphite and potassium or sodium carbonates. Today, however, it is universally used in combination with hydroquinone (replacing the familiar M-Q combination) for plates, films, and papers, so that there is little need to republish the early formulas. I therefore give only a few typical formulas for paramidophenol combined with hydroquinone.

Kodelon-Q for Papers

For Velox, Azo, and bromide papers as used in commercial work, the following formula is advised. Dissolve the chemicals in the order here given: Water, 32 ounces;

Kodelon, 25 grains; hydrochinon, 90 grains; sodium sulphite (E.K.), 330 grains; sodium carbonate, 2¼ ounces; potassium bromide, 4 grains. For Artura Iris, Azo, and development papers used in professional work (portraiture) the formula is slightly modified, as follows: Water, 40 ounces; Kodelon, 10 grains; hydrochinon, 40 grains; sodium sulphite (E.K.), 180 grains; sodium carbonate (E.K.), 180 grains; potassium bromide (saturated solution), 1 drop to each 2 ounces of working developer in use.

Gennert Formula for General Use

The formula advised by Gennert for general use is very similar to the first Kodelon formula given above, viz.: Water, 32 ounces; paramidophenol-hydrochloride (G.G.), 24 grains; hydrokinone (G.G.), 96 grains; sodium sulphite (P.P.G.G.), ⅔ ounce; sodium carbonate (P.P.G.G.), 2¼ ounces; potassium bromide, 5 grains.

For "Soft" Papers

For "soft effect" development papers it is modified as follows: Water, 48 ounces; paramidophenol (G.G.), 11 grains; hydrokinone (G.G.), 55 grains; sodium sulphite (P.P.G.G.), ¾ ounce; sodium carbonate (P.P.G.G.), 1 ounce; potassium bromide, 2½ grains.

Tank Developer

For tank development Gennert advises a combination of paramidophenol, hydroquinone, and pyro, as follows: Dissolve in the order here given: Water, 1 gallon; paramidophenol-hydrochloride (G.G.), 22 grains; hydrokinone (G.G.), 32 grains; sodium sulphite (P.P.G.G.), 1½ ounces; sodium carbonate (P.P.G.G.), 1¼ ounces; sodium bisulphite, 36 grains; pyro, 36 grains; potassium bromide, 6 grains. Develop for 20 minutes at a temperature of 65° Fahr.

Wallace S.M.C. Formula

As a standard formula for development papers Mr. L. H. Wallace, of the Special Materials Company, advises the following: Water, 40 ounces; paramidophenol (S.M.C. para-hydrochlor. or sulphate), 20 grains; hydroquinone, 80 grains; sodium sulphite, 1 ounce; sodium carbonate, 1 ounce; potassium bromide, not to exceed 2 grains or its equivalent in solution. Use less if possible—just sufficient to keep the whites and shadows clear. To *increase the speed* of the development decrease the sulphite by one-quarter and increase the carbonate by the same amount. For slow development, with soft effects, increase the volume of water, increase the proportion of sulphite and decrease the proportion of carbonate. For plates and films this developer may be diluted: e.g. add 1 ounce of water to each 2 ounces of developer in use. Speed up as required with sodium hydrate as advised on an earlier page.

Emergol

The distributors of this product do not divulge its identity, but their description of it and its formulas for use are identical with those given by Andresen for paramidophenol-hydrochloride. Thus, for a single solution developer: Dissolve 6 ounces potassium metabisulphite in 20 ounces of water and add 2 ounces Emergol. To this mixture is added, with constant stirring, sufficient of a saturated solution of caustic soda to dissolve the paramidophenol base precipitated by the first admixture. This gives a concentrated developer. For use dilute 1 part in 20 parts of water and use without potassium bromide. For developing papers the following is suggested: Water, 40 ounces; Emergol, 20 grains; sodium sulphite (dry), 1 ounce; hydrokinone, 70 grains; sodium carbonate (dry), ¾ ounce; potassium metabisulphite, 10 grains; potassium bromide (saturated solution), 1 drop to each 2 ounces of developer in use. "A good all around formula for positive prints on paper and motion picture film" is as follows: Water, 1 gallon; Emergol, 50 grains; sodium metabisulphite, 22 grains; sodium sulphite (dry), 1½ ounces; hydrokinone, 120 grains; sodium carbonate (dry); 2 ounces; potassium bromide, ½ grain.

Tests for Metol

As the majority of the substitutes for metol in the market are paramidophenol in one form or another, or mechanical mixtures of questionable composition, a few simple tests may be useful. I have already given the commonly used test for the purity of paramidophenol (page 434). For the following simple tests for metol I am indebted to Mr. L. H. Wallace.

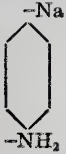
Alcohol Test

First: Metol is insoluble in alcohol. Paramidophenol-hydrochloride and hydroquinone are both completely soluble in alcohol. Inasmuch as metol substitutes are frequently cheapened, and their developing power lessened, by the addition of one or both of these, this test for the purity of metol may be profitable. A weighed sample of "metol" is well shaken in ten parts of alcohol, the residue caught on a filter paper and weighed again when dry. Any loss of weight shows adulteration. Any chemical sold as metol which is soluble in alcohol may be condemned at once.

Bichromate Test

The bichromate of ammonia test is not so simple but is of the highest value, especially in making comparative tests with a known sample of pure metol. First prepare a 10 per cent solution of ammonium bichromate, and a solution of 10 grains to each ounce of water of each sample of metol to be tested. Now take a sheet of clean white blotting paper, such as World Photo Finish, and pour about half a dram of each solution to be tested on different parts of the blotter. Then drop *one drop* of the bichromate solution (by the aid of a medicine dropper) on each wet surface. With *pure* metol solution, a dark, purple-black ring will form at once, with a yellow-colored center, requiring several minutes for the yellow color to darken by oxidation. With impure metol or substitute, the center of the ring will immediately turn dark and the edges will not be clearly defined.

Paramidophenol: Phenolate Compounds



Mention has already been made of the property possessed by paramidophenol of acting as an acid with strong alkalies. Andresen observes that by replacing the hydrogen atom of the OH group—see figure 12, page 423—by an alkali metal such as sodium, a phenolate compound results, e.g. of the composition $C_6H_4ONaNH_2$, which we may call sodium paramidophenolate. In practice this sort of compound is formed when a solution of caustic soda is added to a solution of paramidophenol-hydrochloride.

Unal, Citol, Rodinal, Paranol

Advantage is taken of this to use paramidophenol-hydrochloride as the basis for the preparation of highly concentrated developers of great efficiency, which simply require dilution with water to be ready for use. Such developers, containing phenolate compounds, are Rodinal, Citol, Paraminol, Paranol and (?) Azol. All these are concentrated solutions for dilution with water; Rodinal was also sold as Unal in the form of crystals, the entire contents of the package being dissolved in a given volume of water. They are all patented mixtures, but a developer similar to Rodinal may be prepared as follows:

Formula

In 20 ounces of water dissolve 6 ounces of potassium metabisulphite and then add 2 ounces of paramidophenol hydrochloride. To this mixture add, with constant stirring, sufficient of a saturated solution of caustic soda until the paramidophenol base first precipitated is again dissolved. This concentrated solution should be stored in small bottles, completely filled.

Dilution For Use

In use this concentrated developer, like Rodinal, Paranol, Citol, is diluted with water and restrained, when needed, with potassium bromide (10 per cent solution) according to the sort of negative desired, or the exposure given, or modified to suit the character of the plates, films, or papers in use at the time. In negative development, diluted with from 10 to 20 times its bulk of water, Rodinal (as typical) develops quickly and gives strong contrasts. When further diluted (1:30 or 1:40) development proceeds more slowly and softer contrasts result. Thus for normal exposure use 1 part Rodinal (or other) to 20 parts of water; for over-exposure, take 1 part Rodinal to 10 to 20 parts of water, adding potassium bromide as indicated. For under-exposure, take Rodinal 1 part to 20 to 40 parts of water. For development and bromide papers the dilution should be as 1 to 30, 40 or 50 as the character of the paper may require, with 2 drops of a 10 per cent solution of potassium bromide to each ounce of developing solution. The possibilities of modification are endless.

Metol

Now we approach the crux of the "new" developer problem. It is generally conceded that the universally successful developer—to be produced in America—must either be identical with German metol, or so closely approximating it, in characteristics and performance, that no one will care to ask wherein it differs in one way or another. Many and laborious have been the attempts made in these last few years to produce such a developer—and the end is not yet.

Not Yet "Made in America"

So far as I know, no pure metol, or precise reproduction of German metol, has thus far been produced in America, even in laboratory work. Our American chemists are making splendid strides towards the production of metol equal to the German standard product, and are now very close in working results, though they have not reached clearly defined chemical formulas. It should be remembered that metol, using the word in its proper sense, is incapable of exact analysis, being a patented compound, the commercial manufacture of which has remained a trade secret since its first introduction by Hauff and Andresen, over twenty-five years ago. Moreover, the patents granted to its originators contain no information whatever as to its manufacture, but merely cover its use as developer.

Monomethyl-paramidophenol-sulphate

The developing properties of metol were first observed by Bogisch, but its commercial introduction was due to Hauff (1891), who then described it as the sulphuric acid salt of methylparamido-metacresol, a di-methyl product, having the formula $C_6H_3NHCH_3$ $CH_3OH \frac{H_2SO_4}{2}$. In later years cresol was apparently abandoned as a base in favor of phenol, and Hauff stated his product to be monomethyl-paramidophenol-sulphate, with the formula $C_6H_4OHNHCH_3 \frac{H_2SO_4}{2}$.

What It Is: How Made.

Andresen, who introduced it shortly after Hauff, gives his product the same chemical formula, and tells us that it is derived from paramidophenol by the substitution of one hydrogen atom of the amido (NH_2) group by a methyl (CH_3) group, and is supplied commercially as a sulphate salt. From this it would seem to be a simple matter to make metol by taking paramidophenol, "methylating" it by the introduction of the methyl (CH_3) group by any of the several chemical methods, and then sulphonating it. But in fact the process is not as simple as it seems, and the resulting methylated-paramidophenol-sulphate is not metol. Paul, stating that metol cannot be made by direct methylation, suggests an indirect method, viz., by heating para-hydroglycine (of which the developer glycin is the hydrochloric salt) up to its melting point (247°C.), when it decomposes into carbonic acid and metol (base) which, after sulphonation, yields the metol of commerce.

Metol—Johnson's

Be this as it may, the only actual reproduction of German metol which has as yet appeared is the product introduced by Johnson and Sons, London, in August, 1917, as a "British-made, pure metol (monomethyl-paramidophenol-sulphate). This, it is claimed, is absolutely identical with German metol in chemical composition, constitution, and behavior. It is now obtainable, in limited quantities, in this country. In everyday practical tests it is indistinguishable from German metol, although in appearance it is not as white, and oxidizes more readily than the German product.

Inasmuch as the makers of Metol-Johnsons advise the use of their product in exactly the same proportions as are given in all standard and published metol formulas, where it is used alone, or in combination with hydroquinone or pyro, for plates, films, bromide and development papers, it is unnecessary to publish any specific formulas here.

Swiss Metol

With this exception, we have had occasional supplies of a developer said to be "veritable metol" and not a substitute, imported from Switzerland during the past year or two. This was sold here as "Swiss Metol" and as Monomethyl-Paramidophenol-Sulphate, "guaranteed to be the same chemically as the best German metol." It had the appearance of German metol and gave results precisely similar in practical use. It was said to be of geniune Swiss manufacture, probably from a German-made intermediate.

Elon This developer was introduced by the Eastman Kodak Company some time ago, for use with hydroquinone in a combination said to exactly duplicate the well-known M-Q or Eastman Metol-Quinol developer. Elon is not at present on the market, but the combination referred to, advertised as Tozol, is still obtainable.

Satrapol: Rhodol These two pre-war developers, said to be identical with metol, the first made by Schering and the second by Mallinckrodt, are no longer obtainable.

Monomet Very interesting, but difficult to place, is the British product Monomet, introduced early in 1916 and controlled in America by the Ansco Company. On the other side it is widely used as a universal developer for plates, films, lantern slides, bromide and development papers. In this country it seems to be used chiefly in combination with hydroquinone as a developer for development papers such as Cyko. In practical use for two years it has proved an altogether satisfactory and efficient substitute for German metol.

What Is It? Of the chemical composition of Monomet its makers tell us nothing more than that it is a derivative of cresol—as was the first German metol according to Hauff; and in concentrated solutions with sulphite and alkaline carbonate it throws down a precipitate of amido-cresol base. Its makers advertise it as a "British form of metol" having the following characteristics: (1) "Monomet will go very much further, in regard to the number of prints it will develop, than metol. (2) Monomet is not quite as soluble, in combination with sodium sulphite, as metol," upon which they base the claim that it is 25 per cent purer (as a chemical product) than German metol.

According to the report of the Ansco Research Laboratory, based upon exhaustive analysis and comparisons, it is not identical with German metol, "for metol in an acid solution, when treated with a nitrite, gives the nitrous methyl-paramidophenol-sulphate, whereas Monomet does not."

Characteristics in Use

In appearance Monomet is a grayish powder, keeping well in dry form and in solution. It can be used alone, or in combination with hydrokinone, or for plates, with pyro. It gives greater density in a given time, and is more susceptible to potassium bromide than metol. In ordinary use it does not attack or injure the skin, and it gives a rich, carbon-black image as distinguished from the bluish black given by metol. According to its makers, Monomet can be used as an exact equivalent, weight for weight, for metol in any formula calling for metol, but the caution is given that the proportion of Monomet must not exceed 1½ grains per ounce of water. Note this caution.

Formulas

With the last sentence in mind, it may seem superfluous to give any special formulas for the use of Monomet, but the following British formula for a stock M-Q developer for general amateur use may be interesting: Water, 1 British gallon (160 ounces); Monomet, 240 grains; hydroquinone, 475 grains; sodium sulphite (cryst.), 6 ounces; sodium carbonate (cryst.), 8 ounces; potassium bromide, 32 grains. For use dilute with an equal bulk of water. This is said to keep white and clear (stored in yellow or amber bottles) and thoroughly efficient for months.

Methylol: Methylated-Paramidophenol-Sulphate

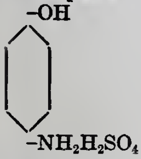
The nearest approach to metol made in America seems to be the product introduced as Methylol by the Special Materials Company, of New York. This, as I am reliably informed, is a methylated-paramidophenol-sulphate—which is not metol. The precise chemical formula of Methylol is not yet determined, but is probably about as follows, the (x), here as elsewhere, denominating "an unknown quantity": $C_6H_4OHNH_2(x)H_2SO_4$. The similarity between this and the chemical formula of metol given on page 441 will be noted, together with the absence of the methyl (CH_3) group.

Formulas

A typical formula for development papers is as follows: Water, 32 ounces; Methylol, 15 grains; hydroquinone, 60 grains; sodium sulphite (dry), ¾ ounce; sodium carbonate (dry), 1 ounce; potassium bromide (10 per cent solution), 5 to 10 drops. Use only sufficient potass. brom. to keep the whites clear.

For plates, films, and "soft effect" papers: Water, 32 ounces; Methylol, 10 grains; hydroquinone, 40 grains; sodium sulphite (dry), ½ ounce; sodium carbonate (dry), ½ ounce; potassium bromide, 2 grains. It is recommended that the potass. brom. be first dissolved in an ounce of the water and added to the developer after the other ingredients have completely dissolved. These formulas are, of course, equally serviceable for use with any reliable make of methylated paramidophenol-sulphate (e.g. Gennert's Paramet).

Paramidophenol-Sulphate



Combined with sulphuric acid, paramidophenol (base) gives us paramidophenol-sulphate, a developer introduced by many American and British firms as replacing metol. An average sample contains over 67 per cent paramidophenol, but some brands claim a much higher percentage. It is sold under its proper name as paramidophenol-sulphate, and under many trade names, as Kathol, Fredol, Duital, Mitus (?), Serchol, etc.

Conflicting Claims

Strangely conflicting claims are made for paramidophenol-sulphate as a developer compared with other phenol derivatives. Some makers claim that it is preferable to paramidophenol-hydrochloride, others that it is superior to metol in developing power, while, on the other hand, there are those who say that it is not equal to either in keeping quality, speed of development and capacity for repeated use up to exhaustion.

A Possible Explanation

It may be that the conflict arises from a misunderstanding. Paramidophenol-sulphate used with the alkaline carbonates is undoubtedly "slower" than metol, and, in this respect the chloride salt is perhaps preferable.

Also, paramidophenol-sulphate precipitates paramidophenol (base) in sodium sulphite and carbonate solutions, which robs the solution of developing power and so "slows up" its action. This is clearly seen in the repeated or long-continued use of such a developer. But by the addition of a small amount of sodium hydrate (caustic soda) the "speed" of the developer can be readily brought up to the metol standard, and by the occasional further addition of sodium hydrate in small amounts, this speed and developing power can be so completely maintained that, with this modification, paramidophenol-sulphate will develop as rapidly and go as far as metol, and probably farther than paramidophenol-hydrochloride. This point was given special emphasis in the literature introducing Kathol—a paramidophenol-sulphate developer of the best sort. Photographers, however, cling to an old-time prejudice against the use of caustic alkalies, and prejudice—is prejudice! It is now known that the peculiar advantages sought to be gained by the use of caustic soda with paramidophenol-sulphate are equally well secured by methylating the paramidophenol during its manufacture, so that the use of caustic soda can be eliminated and an energetic, speedy, and lasting developer made up with alkaline carbonates. For which reason it is probable that paramidophenol-sulphate will soon be generally replaced (commercially) by methylated paramidophenol-sulphate.

Characteristics in Use

In use paramidophenol-sulphate is invariably combined with hydroquinone, whether for plates, films, or papers. It is a clean, rapid-working developer, giving detail quickly and building up density more slowly. With some brands the use of sodium hydrate is suggested as a means of controlling the speed of or reënergizing the developing solution when it seems to "slow down," but other makes claim that "no caustic soda is required" in their use. In the latter case one may surmise that they are either "methylated" products, or the hydrochloride salt in disguise, or simply high-grade paramidophenol-sulphate with its characteristic virtues and shortcomings. Given a well-balanced formula and normal exposure, paramidophenol-sulphate yields negatives of good gradation, clear in the whites and without veil in the shadows, and of a rich, black color. It is very susceptible to the restraining power of potassium bromide, which should be used with caution and rarely in excess of 1 grain potass. brom. to each 7 to 10 grains of developer. This caution is especially to be noted where paramidophenol-sulphate is used to replace metol (in equivalent amounts) in any metol formula.

Duital Typical formulas for some of the many brands of paramidophenol-sulphate are as follows: Duital for development papers, plates, and films—Water, 16 ounces; Duital, 15 grains; hydroquinone, 48 grains; sodium sulphite (dry), ⅓ ounce; sodium carbonate (dry), 1⅛ ounces; potassium bromide, 2 grains or more, as required. For plates and films add 1 ounce of water to each 2 ounces of the above. For tank development: Water, 1 gallon; Duital, 90 grains; hydroquinone, 360 grains; sodium sulphite (dry), 3 ounces; sodium carbonate (dry), 9 ounces; potassium carbonate, 15 grains. Develop 20 minutes at 65° Fahr.

Fredol The standard developer for Rexo and other development papers is: Water, 40 ounces; Fredol, 20 grains; hydroquinone, 60 grains; sodium sulphite (dry), ¾ ounce; sodium carbonate (dry), 1 ounce; potassium bromide, 12 grains. For plates and films dilute the quantity used with an equal volume of water.

Kathol This developer has recently been modified for use without sodium hydrate. A typical formula for plates, films, and "soft effect" papers is: Water, 40 ounces; Kathol, 10 grains; hydroquinone, 40 grains; sodium sulphite (dry), 1 ounce; sodium carbonate (dry), ¾ ounce; potassium bromide, 3 grains (previously dissolved in a little water and added in solution). A formula for development papers, generally, is: Water, 32 ounces; Kathol, 20 grains; hydroquinone, 60 grains; sodium sulphite (dry), 1 ounce; sodium carbonate (dry), 1 ounce; potassium bromide, 2 grains (added as directed in the second methylol formula).

Mitus This is said to be "95 per cent pure paramidophenol-sulphate," nevertheless the following formula (without caustic soda) is advised for tank development: Water, 1 gallon; Mitus, ½ ounce; hydroquinone, ¾ ounce; sodium sulphite, 5 ounces; sodium carbonate, 3 ounces; potassium metabisulphite, 80 grains; potassium bromide, 25 grains. Add water to make the bulk of the solution up to 5 gallons. Develop 20 minutes at 65° Fahr. For development papers use the second Kathol formula above, but substitute an equal amount of Mitus for the Kathol specified in that formula.

Serchol This is a British product which is probably paramidophenol-sulphate or the hydrochloride salt of high grade. It can be used with hydroquinone for development papers; with pyro for plates and films; or alone as a single-solution developer for plates or papers. Typical formulas are as follows: For bromide and gaslight papers, and lantern slides: Water, 20 ounces; Serchol, 6 grains; hydroquinone, 18 grains; sodium sulphite (cryst.), 120 grains; sodium carbonate, 120 grains; potassium bromide, 1 grain. For tank development, 20 minutes at 65° Fahr: Water, 36 ounces; Serchol, 6 grains; hydroquinone, 18 grains; sodium sulphite (cryst.), 1½ ounces; sodium carbonate (cryst.), 120 grains; potassium bromide (10 per cent solution), 10 drops. The Serchol-Pyro formula is said to be especially advantageous for cases of known under-exposure. Make up two solutions, as follows: No. 1—Water, 20 ounces; Serchol, 40 grains; pyro, 48 grains; potassium metabisulphite, 100 grains. No. 2—Water, 20 ounces; sodium carbonate (cryst,). 2 ounces; potassium bromide, 10 grains. For use take equal parts, increasing the proportion of No. 2 where under-exposure is known or indicated.

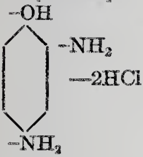
Tonall Tonall is a developer of American manufacture offered as "the most perfect equivalent for metol on the market." The chemical name is given as mono-methyl-paramidophenol-chloride, which must be a printer's blunder! It is said to keep well in solution, is suitable for tank development, films and papers, and to be much more energetic than most metol substitutes.

Whartol This is an American product of unknown composition but said to possess "the forcing power of metol, is easier to control and does not fog as quickly." It is used in equivalent amount to replace metol in any metol formula, with the caution that Whartol needs only one-third the amount of potassium bromide generally used with metol. These claims indicate that it is either paramidophenol-hydrochloride or paramidophenol-sulphate—plain or methylated.

Tarcole A developer of the same general class as the above, i.e. either the sulphate or hydrochloride form of paramidophenol, is offered by a Cleveland, Ohio, firm as possessing good qualities. It is an American product and is said to be equally suitable for all classes of photographic work. I have not had an opportunity to test its working qualities, and the only announcement of it which has appeared tells nothing of its chemical composition or of formulas for use.

Scalol Under this name Johnson & Sons, a few years ago, introduced a developer intended to replace metol, used in combination with hydroquinone or pyro. Its chemical composition was not divulged, but from its characteristic behavior and results it was probably either the hydrochloride or sulphate salt of paramidophenol. It would seem to have been superseded by the same makers' Metol-Johnsons.

Diamidophenol-hydrochloride [Amidol] By replacing two hydrogen (H) atoms in the *ortho* and *para* positions in phenol (Fig. 5, page 420) by two amido (NH_2) groups, Hauff, in 1892, obtained diamidophenol, the hydrochloride salt of which, $C_6H_3OH(NH_2)_2—2HCl$, was later introduced commercially by Hauff and Andresen under the trade name Amidol. Dianol (Lumière), Nerol (Schering), Amidol-Johnson, and Acrol (Eastman) are chemically identical products. It is



also sold under its proper name, e.g. Diamidophenol (Eastman; Gennert; S.M.C; etc.). It is now made in America and Britain, the German brands being no longer available. The original German Amidol is a steel-blue, needle-like crystal, which remains clear and colorless in solution, but is liable to lose its developing power after a time. The American product is of a yellow color and comes in larger crystals. Its quality is excellent, but it oxidizes more readily than the European brands, with visible coloration, an advantage as visibly showing the deterioration of the solution.

Characteristics Diamidophenol is readily soluble in water, and somewhat sensitive to temperature. The working solution should be kept between 60° and 65° Fahr. When added in small quantities, potassium bromide acts with Amidol only as a clearer, fairly large amounts being needed to act as a restrainer.

In Use Under whatever name, diamidophenol-hydrochloride possesses remarkable properties as a developer, and deserves a wider appreciation for general use than it has thus far received. Its chief characteristic is its power as an active developer in combination with sodium sulphite alone, without the addition of alkalies. It is acknowledged to be without an equal as a developer for bromide paper, working rapidly, without fog or stain, and giving prints of fine gradation, with a rich, velvety, bluish black color. Because of its clean working properties and the fine grain it yields, it is excellent for lantern-slide work and should be equally serviceable for motion-picture positives. It can also be made to give very pleasing results in negative and film development. It is important that the sodium sulphite used in making up an amidol developer should be perfectly fresh and not stale or oxidized, whether in solution or solid. The developing solution can be used repeatedly as long as it does not show coloration or other sign of loss of power by oxidation. As the density or color given by amidol is slightly lost in the fixing bath, development should be carried a little further than the tone or density desired, which applies to prints and plates.

Formulas For the reasons already given, it is preferable to make up amidol developers only in the quantity required for a day's use. Typical formulas are as follows: For plates and films.—Water, 10 ounces; sodium sulphite (cryst.), 1 ounce, or dry, ½ ounce; diamidophenol (Amidol, etc.), 40 grains. Restrain with potassium bromide (10 per cent solution) as needed. Underexposure can be helped by the addition of 10 per cent sodium sulphite solution as indicated.

For bromide papers: Water, 20 ounces; sodium sulphite (dry), 320 grains; potassium metabisulphite, 120 grains; diamidophenol (Amidol, etc.), 60 grains; potassium bromide, 5 grains. (Dilute for gray tones). For lantern-slide plates: Water, 10 ounces; sodium sulphite (dry), 150 grains; diamidophenol, 50 grains; potassium bromide, 3 grains.

For tank development with Dianol: Water, 60 ounces; sodium sulphite (dry), 180 grains; potassium bromide (10 per cent solution), ½ ounce; Dianol, 45 grains. Develop 30 minutes at 65° Fahr.

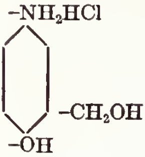
Duratol This developer, said to be benzylparamidophenol, was introduced by Schering as a universal developer, to be used in combination with hydroquinone. It won great favor upon its first introduction (1911–12) but is no longer obtainable.

Duratol is a soft-working developer of the metol class, especially suitable for instantaneous work. It is stable in solution, free from tendency to fog or stain, does not injure the hands, and has unusual developing power, i.e. it is not quickly exhausted, in which it surpasses other derivatives of paramidophenol.

A typical formula is: Hot water, 32 ounces; Duratol, 15 grains; sodium sulphite (dry), 1 ounce; sodium carbonate (dry), 1½ ounces; hydroquinone, 75 grains.

Duratol-solution was a concentrated form of this developer, requiring only dilution with water to be ready for use. For normal exposure, it was diluted with 16 parts of water; for underexposure, with 30 to 40 parts; for overexposure, with 8 to 10 parts of water, and the addition of potass. bromide.

Edinol

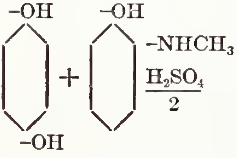


This developer was first introduced (as Paramol) by the Bayer Co. in 1901, as the outcome of a new method for the preparation of oxyalcohols of the aromatic series, worked out by Eichengrün in 1899. The formation of the compound, as briefly explained by Schweitzer before the American Chemical Society in 1903, is too complex for publication here. Suffice it to say, therefore, that edinol is the hydrochloride salt of meta-amido-ortho-oxy-benzy-alcohol, known to the chemist by the formula $C_6H_3OHCH_2OHNH_2HCl$.

Characteristics

As a developer it stands between the slow type, such as pyro, hydroquinone, and the rapid types such as metol, rodinal, amidol, with properties peculiar to itself. It comes in the form of a yellowish crystalline mass. On account of its great solubility it permits the preparation of concentrated stock solutions. In use it is free from fog and staining tendencies and it is non-poisonous, i.e. does not attack the fingers. It is a clear working developer, permits the use of large amounts of potassium bromide without noticeably affecting the contrasts of the image, and is an excellent developer for plates and films, but especially desirable for lantern slides and bromide papers and can be used repeatedly. It is used alone with alkaline carbonates, or in combination with hydroquinone or adurol. At present edinol is not obtainable in this country, but edinol-hydroquinone in powder form, ready for use by simply dissolving in a given quantity of water, is still available. This stock solution is diluted (like Rodinal) according to use.

Ortol



By a molecular combination of hydroquinone with methyl - ortho - amidophenol (1:2), Hauff in 1896 obtained a very useful developer with distinctive properties, which he introduced under the trade name Ortol. Commercially, it is the sulphate of mono-methyl-ortho-amidophenol with hydroquinone, having the formula $C_6H_4(OH)_2 + C_6H_4OHNHCH_3 - \frac{H_2SO_4}{2}$ Roylon is a similar mixture, used as an equivalent and giving identical results.

Characteristics Ortol comes as a coarse, yellowish, crystalline powder, very soluble in water. As a developer it stands between pyro and the familiar metol-hydroquinone combination. In its dry state it oxidizes readily, but may be kept unchanged for years in well-stoppered, orange-colored bottles. In solution with potassium metabisulphite it retains its power and keeps well, colorless, for many months. It gains in developing power in combination with alkaline sulphites and sodium carbonate, and is very sensitive to the retarding action of potassium bromide, which makes it readily controllable for plates which have been overexposed. It has no injurious action on the hands, and gives a brown-black image of fine grain. It can be used as a universal developer, by modification, for plates, films and papers or for lantern slides, and can be combined with hydroquinone.

Formulas A favorite two-solution developer for plates or films is: No. 1—Water, 20 ounces; potass. metabisulphite, 50 grains; ortol, 100 grains. No. 2—Water, 20 ounces; sodium carbonate (cryst.), 2 ounces; sodium sulphite (cryst.), 2 ounces. For use, take equal parts Nos. 1 and 2 and water, with 2 to 5 drops of a 10 per cent solution of potass. bromide for each ounce of mixed developer.

Single Solution A good single solution developer for plates or films is: Water, 8 to 12 ounces (according to subject and exposure); ortol, 12 grains; potass. metabisulphite, 6 grains; sodium sulphite (cryst.), 120 grains; potass. carbonate (cryst.), 50 grains; potass. ferrocyanide (cryst.), 20 grains. Potassium bromide is not needed with this formula, the ferrocyanide retarding development slightly, giving clearness and vigor.

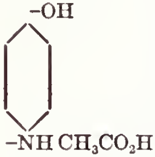
Tank Development For tank development (plates) where widely different exposures have to be dealt with, take: Water, 20 ounces; potass. metabisulphite, 5 grains; ortol, 10 grains;

sodium sulphite (cryst.), 65 grains; sodium carbonate (cryst.), 65 grains. Examine the negatives after 15 minutes and remove as the desired density is reached. Temperature 65° Fahr.

Bromide Papers

For bromide papers, combine with hydroquinone, as follows: Water, 20 ounces; ortol, 15 grains; sodium sulphite (cryst.), 190 grains; hydroquinone, 45 grains; sodium carbonate (cryst.), 160 grains; add a few drops of a saturated solution of potassium bromide, sufficient to keep the whites clear.

Glycin



Glycin is a derivative of paramidophenol, formed by replacing one hydrogen (H) atom in the amido (NH_2) group by the monovalent group CH_3 CO_2H. It was introduced simultaneously by Hauff and Andresen as a developer peculiarly adapted for tank development or for negatives where a very fine, close-grained image is desirable but is not now obtainable. It is known to chemists as para-oxy-phenyl-amido-acetic acid, with the formula $C_6H_4OHNHCH_3CO_2H$.

Preparation-: Characteristics

Glycin is commercially prepared by heating an aqueous, alkaline solution of paramidophenol (base) and chlor-acetic acid in molecular proportion of 2:1. On cooling, this gives a glistening, gray crystalline powder, i.e. glycin, which is insoluble in water, but soluble in sodium sulphite and carbonate solutions, with which it forms a slow but powerful developer, giving fine-grained images of a warm black color. It may be used with hydroquinone or pyro for plates and films, but is generally used alone as a tank developer for plates, lantern slides and reproduction work.

Formula

Miller gives the following formula for tank use: Hot water, 5 ounces; sodium sulphite (dry), 140 grains; sodium carbonate (dry), 140 grains; glycin, 280 grains. This, made up to 8 ounces with water, forms a stock solution. For use take 1 ounce of this to 32 ounces of water. Develop 30 minutes at 50° Fahr.

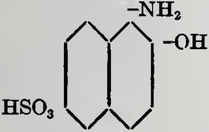
Caution Note that in the use of glycin it is absolutely essential to wash the plates after development before putting them into the fixing bath. Stains will result if this is not done.

Hydramine This is a chemical combination of hydroquinone with para-phenylenediamine, made by Lumière and sold under the trade name hydramine, but not obtainable in this market. It has the formula $C_6H_4 (OH)_2 + C_6H_4 (NH_2)_2$. The developing properties of para-phenylenediamine were made known by Andresen in 1888, the combination with hydroquinone being due, apparently, to Hauff. Commercially, para-phenylenediamine is prepared by adding acetic acid to aniline, which is nitrated in the usual way, giving para-nitro-acetanilid which, after reduction by hydrogen, yields para-phenylenediamine.

Characteristics Hydramine comes in white scales or powder, readily soluble in warm water, and in conjunction with caustic lithia or formosulphite and sodium sulphite, gives a slow-working but energetic developer, which keeps well and does not stain or attack the skin.

Formula A formula given by Lumière is as follows: Water, 20 ounces; sodium sulphite (dry), 144 grains; caustic lithia, 29 grains; when dissolved, add hydramine, 48 grains. Use a few drops of a saturated solution of potass. bromide per ounce of developer as restrainer when its need is indicated by veiling or tendency to fog.

Eikonogen



The developer we know as Eikonogen, or as it is properly spelled, Ikonogen, belongs to a different family from those we have thus far considered, being a naphthalene derivative. Its developing properties were first made known by Meldola, but its commercial introduction was due to Andresen who, in 1889, gave it the name of Eikonogen—known to the chemist as sodium-amido-beta-naphthol-sulphonic acid, with the formula $C_{10}H_5OHNH_2HSO_3$.

Characteristics Eikonogen comes as a mass of semi-opaque, yellowish crystals with a shining luster, sparingly soluble in cold, but readily soluble in boiling water. Used alone, it is a soft-working developer, giving abundant detail and gradually building up density. It is generally used with hydroquinone, is sensitive to the action of potassium bromide, works cleanly without fog, and does not stain the fingers nor injure the skin.

Formula A reliable two solution formula is as follows: No. 1.—Water, 24 ounces; sodium sulphite (dry), 1 ounce; Eikonogen, 120 grains; hydroquinone, 30 grains. No. 2.—Water, 16 ounces; sodium carbonate (dry), 2 ounces. For plates, films, and lanter slides take 3 ounces of No. 1 and 1 ounce No. 2. For bromide and gaslight papers, add 1 or 2 drops of a saturated solution of potass. bromide to each 4 ounces of the developing solution.

Diogen: Imogen: Tylol: Diphenal These, as far as I know, have not been in the market for some years, and may therefore be dismissed with little attention here. Diogen, as seen in Fig. 19, page 424, is closely related to eikonogen. It was introduced by the A.G.F.A. Co. as a whitish powder, forming a concentrated developer with sodium sulphite and potassium carbonate, which was diluted for use. Imogen, also an A.G.F.A. Co. product, comes as a white powder, easily soluble in hot water, giving, with sodium sulphite and sodium carbonate, a fairly quick-working developer, free from fogging or staining tendencies, and somewhat retarded by low temperatures. Tylol is a French product, derived from a phenol base. It comes as a gray powder, readily soluble in water; used with sodium sulphite and carbonate, it forms a rapid developer of the metol class and is, therefore, generally combined with hydroquinone. Diphenal, an A.G.F.A. product, was a concentrated solution developer based on diamido-oxydiphenyl (see Figs. 20 and 21, page 424). It was peculiarly suited for the development of overexposures, being free from fogging tendencies, and in use was diluted with from 15 to 25 parts of water according to subject and exposure.

Drawing to the End

We have now reached the end of this brief survey of the photographic developers available or in use today. Some of them might have been dealt with at great length with profit, but my space did not permit of this. Two or three American-made developers have been intentionally passed over without mention, simply because their makers persistently ignored my requests for information, and I have been unable to obtain the products from dealers. Oblivion best befits such—makers and products.

Hitol

There remain only the mechanical mixtures, or ready-prepared-for-use developers, of which Hitol, Rytol and Kalogen are prominent examples. Of these Hitol only claims special mention, because of its really remarkable lasting power, or capacity for repeated use before exhaustion. This will be referred to in detail in the February issue of The Photo-Miniature, which will deal with the modern methods of development—appropriately following this discussion of the developers themselves.

Samuel Wein, B.Sc.

Notes and Comment

The current revivial of interest in home-prepared printing papers has brought me many questions as to the best papers for this use. These questions are all answered in three words, viz.: Use Whatman Papers. A note concerning Whatman Papers is in preparation for the February issue. Meanwhile readers who are seeking absolutely pure, hand-made papers as a basis for the preparation of plain silver, kallitype, platinum or gum bichromate printing papers, should write H. Reeves Angel & Co., 120 Liberty Street, New York City, for the sample book of Whatman Papers, and see for themselves.

Gardens East and West. An exhibition of pictorial photographs of gardens in California, Long Island, Connecticut and Rhode Island, by Frances Benjamin Johnston, was held at the Touchstone Galleries, New York, in December. It comprised about sixty 14 x 17 prints on Japanese tissue, in a warm, black tone, and afforded a noteworthy showing of Miss Johnston's inimitable skill in this field, to which she has devoted herself for some years past.

An exhibition of war photographs by the Royal Flying Corps is being given at the Camera Club, London. The combination of practical photographic work with remarkable examples of aërial landscape, cloud formations and the like, gives this exhibition a unique interest. It is much to be desired that such an exhibition could be given in our American cities, as giving a foretaste of what may be expected from the new Photographic Division of the U. S. Signal Service Corps which has enlisted the services of many notable American photographic workers.

This is the day of standardization. We have learned that, in photography, this way lies progress and success. For which reason it is interesting to note that the new factory of the Central Dry Plate Co., of Benavis, St. Louis, Mo., has been planned, built and equipped with this single aim, viz: the production of a definite and standardized product. It means success—for the makers as well as the users of Central dry plates.

The new factory comprises a group of buildings covering about nine acres, on the very site formerly occupied by the M. A. Seed Dry Plate Co. at Woodland (renamed Benavis). It has been designed and equipped exclusively for the manufacture of a complete line of dry plates, for general and special photographic uses, particular stress being placed on the provision of a research laboratory which will keep the Central products abreast of every scientific and practical advance in the production of perfect plates and color filters for all processes. The Central Dry Plate Co. is now headed by Mr. F. Ernest Cramer, with a large crops of skilled workers, including Mr. R. James Wallace. The combination of a group of such men and a manufacturing plant of the sort indicated promises an interesting evolution in American photography, and I hope to keep the readers of THE PHOTO-MINIATURE informed of the activities of the organization.

Underwood & Underwood, of New York, long famous as the world's largest manufacturers of stereoscopic views and news pictures for publication, have incorporated their activities in an $8,000,000 company, and plan to establish a chain of branches throughout the country to follow the wide developments in commercial photography.

An illustrated paper explaining the Unit System of Photography by its author, F. M. Steadman, appears in the December issue of "Photo-Era" (Boston, 20 cents). Those who are curious as to the working and efficiency of this system will do well to see this issue of the "Photo-

Era," which also offers an extremely interesting article by J. W. Kilmer on "Photography in Colors—The Visual Index."

A supply of platinotype (sepia), palliadotype and satista papers has been received by Willis & Clements, of Philadelphia, and those who favor these beautiful papers should lose no time in acquiring sufficient for their needs.

Pleasing brown tones on gaslight papers by simple development are said to be obtainable by the use of pyrocatechin and sodium carbonate. The method and formula advised are published in the December issue of "The Camera" (Philadelphia, 15 cents).

The taking, projecting and printing of "movie" portraits on glass plate, by the system invented by Lieutenant G. Bettini, was practically demonstrated at the Hero Land Bazaar recently held in New York. This system, which is intended for studio or home use, gives hundreds of small portraits on a glass plate about 5 x 8 inches, any one of which images may be enlarged at will.

ABOUT LENSES. This is a booklet of 26 pages, published by the Eastman Kodak Company, Rochester, N. Y., for free distribution, and is intended to give, in clear and simple language, such information about lenses as will enable the inexperienced to select such a lens as is best fitted for the particular requirements of individual use. It does just that and is well worth sending for. The text is unusually clear and direct in its information and some twenty-four diagrams materially add to the value of the brochure.

Pictorial Photographers of America

The Pictorial Photographers of America have completed their first year of activity as a formal organization. On Monday evening November 5, 1917, the annual election of officers was held at the National Arts Club, New York City. Past work was reviewed and work to be done in the future was discussed.

The principal achievement of the P. P. of A. has been the launching of two traveling exhibitions of the work of members, each group numbering more than one hundred prints. The "tour" began in Minneapolis in September, 1917, and the last showing will be in New Orleans in May 1918. The complete schedule for the two groups follows:

Western Group of Prints. Minneapolis Institute of Arts, September, 1917; Milwaukee Art Institute, October; Art Institute of Chicago, November; City Art Museum, St. Louis, December; Toledo Museum of Art, January, 1918; Detroit Museum of Art, February; Cleveland Art Museum, March; Cincinnati Museum of Art, April.

Eastern Group of Prints. Newark Museum Association, October, 1917; New Britain Institute, Conn., November; Worcester Art Museum, December; Syracuse Museum of Fine Arts, January, 1918; Guild of Allied Arts, Buffalo, February; Grand Rapids Art Association, March; University of Oklahoma, April; New Orleans Art Association, May.

At the monthly meetings, held on the first Monday evening of each month, from October to May, at the National Arts Club, New York City, lectures and lantern-slide talks are given. Among those who addressed the members last year were Henry H. Sayler, editor of *The New Country Life;* Robert J. Cole, art critic of the New York *Evening Sun;* Walter G. Wolfe; Major Kendall Banning, of the Photographic Division, U. S. Army, Signal Corps.

Last summer the members were the guests for three days of Clarence H. White, at Canaan, Conn. Picnics, talks, lantern-slide exhibitions, earnest debates on filters, tanks, and lenses, and just plain fun, kept everyone busy, and these summer reunions will be made a permanent feature of the organization's activities.

Following is a list of the officers, and a résumé of the objects of the P. P. of A. Clarence H. White, President; Dr. A. D. Chaffee, Vice-President; Gertrude Kasebier, Hon. Vice-President; Dr. Charles H. Jaeger, Treasurer; Arthur D. Chapman, Corresponding Secretary; Edward R. Dickson, Secretary.

The aims of the P. P. of A. are: (*a*) To stimulate and encourage those engaged and interested in the art of photography.

(*b*) To honor those who have given valued service to the advancement of photography.

(*c*) To form centers for intercourse and for exchange of views.

(*d*) To facilitate the formation of centers where photographs may always be seen and purchased by the public.

(*e*) To enlist the aid of museums and public libraries in adding photographic prints to their departments.

(*f*) To stimulate public taste through exhibitions, lectures, and publications.

(*g*) To invite exhibits of foreign work and encourage participation in exhibitions held in foreign countries.

(*h*) To promote education in this art, so as to raise the standards of photography in the United States of America.

All photographers who are interested in the aims and the work of the Pictorial Photographers of America are welcome at the monthly meetings.—*Pictorial Photographers of America, 119 East 19th Street, New York City.*

Books and Prints

PHOTOGRAPHY IN COLOURS. A textbook for amateurs and students of physics. By George Lindsay Johnson, M.A., M.D. Third edition; 302 pages; with 14 plates (5 in color) and many illustrations in the text. Cloth $2. (Dutton.) For sale by Tennant and Ward, New York.

Within the past few weeks three men have come to me, each claiming, as the result of years of patient experimenting, to have finally solved the problem of photography in colors. One brought direct color transparencies on glass plates, flat, roll and cinematograph films and prints in color on paper. Another brought color prints on paper only, and the third had films for cinematograph projection, having shown me successful color prints on paper two years ago. Since these processes are not yet commercially available, I was asked to say nothing definite about them. At least a dozen such processes are brought forward every year. Some are introduced commercially, others never reach that stage. Of those so introduced, some few enjoy a brief popularity, others fail, or are withdrawn from the market. The perfect process or method has not yet arrived.

Public interest in the problem, however, is as keen today as it was fifty years ago, and the evolution or development of photography in colors forms perhaps the most absorbingly interesting chapter in the history of photography. Something of this development has been set forth in THE PHOTO-MINIATURE, Nos. 38, 81, 128 and 147. The "Color Photography Supplement" issued monthly with "The British Journal of Photography" offers a complete summary of current progress in new and old processes. And there have been three or four books on the subject, all now, I believe, out of print and difficult to find.

These apart, Dr. Johnson's "Photography in Colours," here noticed, is the only textbook on the subject at present available. This is the third edition and, in addition to the matter given in earlier editions, contains a full description of the Raydex process, as well as Gaumont's new method of cinematography in colors and Carrara's method of reproducing Autochromes on paper. A chapter has also been added on Art in Color Photography and a further chapter on Photomicrography in Color.

The author's residence in Johannesburg, South Africa, for a year or two past, doubtless accounts for his failure to mention the most recent developments in color photography in America, e. g. the Hess-Ives Hicro, the Kodachrome, the Kunz and the Warner-Powrie processes. In other respects the book is comprehensive in its treatment of the subject, beginning with an explanation of the nature of light and color and touching every phase of the problem down to the latest methods of photomicrography in color.

Clarence H. White. A few days ago I spent a happy hour with Clarence H. White, at his School of Photography in the old Washington Irving house on East 17th Street, New York City, looking over the work of the students of the School. Judging by the work I saw, the scheme of instruction followed at this School deserves the highest praise. It consists of lectures and practical work under competent instructors, covering the fundamental principles of photography and their application in practical and pictorial work. The albums of prints representing various "problems" worked out by the students unaided by their teachers, were most interesting and demonstrated, in a striking way, the efficiency of the methods of teaching employed.

Alvin Langdon Coburn
W. A. T. Sweatman
1917

W. A. T. SWEATMAN
Alvin Langdon Coburn
1917

"Pals" W. A. T. Sweatman

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The Photo-Miniature
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EDITED BY JOHN A. TENNANT

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How to Develop the Negative

The development of the negative has always been a point of supreme interest in the photographic process. It was a revelation to Daguerre—and the beginning of photography—when, coming to his chemical cupboard one morning in the year 1838, he found that the invisible picture image he had obtained the day before upon an iodized silver plate had been developed to full visibility by the vapors escaping from a flask of mercury, accidentally left unstoppered overnight in that historic cupboard. It is still a revelation, big with interest, to the amateur of 1918 who, in the dim, religious light of the darkroom, first watches the appearance and visible growth of the photographic image on his plate or film under the action of the developer.

Today, however, most of us are content to know what happens in the development of the negative, and to learn how the record secured by exposure can most simply and surely be transformed into a printing plate—without much seeking to watch the transformation in its actual progress. We are, moreover, being Prussianized, so to speak, into the complacent belief that development is purely an automatic process, proceeding by fixed rule to a predetermined end, and that it is alike useless to watch its progress or seek to control the result. In spite of which comfortable doctrine it is plain that the more we know about our developing agents and the process of development itself, the more surely we can control its functioning, and vary the character of the result so far as individual requirements as to the print are concerned.

Control

Let us make no mistake about this control. The old belief that by "tinkering with the developer" one can compensate for gross error in exposure, and make a good ending (in the negative) out of a bad beginning (in the exposure), was false and no longer holds. But it is still true that by a skillful balancing of the developing solution, in its adjustment to the character of the plate or film used, and to the general character of the subject photographed, always keeping in view the particular printing medium to be employed in making the finished print, those who know how can work wonders in the development of the plate. To the cognoscenti, indeed, the Law, as given by Hurter and Driffield, binds only those who seek an absolutely truthful representation of the subject photographed. But Heaven be my witness to the protest that the plain, unvarnished truth as to men and things is neither always desirable, nor to be insisted upon too rigidly.

With this in mind, let us read what is here set forth concerning the development of the negative, as seen by many different workers from different view-points. First, a word about the photographic image.

The Photographic Image

The light-sensitive film with which our plates and films are coated consists of gelatine emulsion in which silver bromide, in an extremely fine state of division, is very evenly distributed. When such a plate or film is exposed in the camera, the points of light (or light intensities as they are called) reflected by the subject before the camera pass through the lens and work upon the sensitive surface of the plate a change which, in effect, gives an image or record of the form and light and shade contrasts of the subject. This image given by exposure is invisible, but we know that it is there and that it can be made visible, hence we name it the latent image. The chemical compounds which have the power to develop or bring out and make visible this latent image we call developers, and the use of these developers in bringing out the picture image obtained by exposure is known as the process of development. The chemical action of a developer is to reduce to black metallic silver those atoms of silver bromide which have been acted upon by the light during exposure; hence developing agents are reducers, and development is a process of chemical reduction. The first step, therefore, in any consideration of development is to study the developer and how it is prepared for the work it has to do.

Developing Agents

The nature and properties of the many different compounds introduced commercially as photographic developers are fully dealt with in THE PHOTO-MINIATURE No. 167, where typical formulas are given for their use. As was there explained, these developing agents or reducers are not, of themselves, capable of developing the photographic image, but require the addition of other chemical compounds to energize and control their action.

Compounding a Developer

Thus, in practice, the developing solution is generally made up of the developing agent proper as a base, with a preservative to keep its developing power unimpaired by oxidation, or its efficiency, or clearness, when in solution; an accelerator, which energizes or sets the active developing agent in motion and speeds its work; and a restrainer, which is used to retard the reducing action of the solution, or to keep the plate from fogging—which may arise from various causes.

Choice of a Developer

The choice of a particular developing agent is wholly a matter of individual opinion, depending largely upon the value the worker places upon this or that quality he desires in the negative. So far as producing good printing negatives is concerned, they differ only in minor details and produce practically the same results if properly used. But they have different properties in use. Thus, pyro is apt to stain the fingers if constantly used, while metol poisons or irritates the skin in some cases, causing much inconvenience and trouble. Some are very rapid in action and others intolerably slow.

Some are difficult to get or keep in solution and so on. A careful reading of The Photo-Miniature No. 167 will best guide the reader who still has an open mind. Of all known developing agents, pyro is undoubtedly that most widely used, with a combination of metol and hydroquinone as second choice. Today we are turning to paramidophenol because of the difficulty of obtaining metol, due to the war.

Preservatives

The preservative most generally employed in preparing developing solutions is sodium sulphite. A notable exception is pyro, with which an acid (oxalic or sulphuric acid) is often employed, or an acid salt such as potassium metabisulphite, or a mixture of acetone and sulphite. Where a pyro solution is made up with an acid preservative, as mentioned, sodium sulphite is added as a means of controlling the color (or staining) of the negative in development, which is of great importance in determining the "printing quality" of the negative.

Accelerators

With the exception of amidol, which will do its work with the simple addition of sodium sulphite, and the "prepared-for-use" developers, such as Rodinal, Paranol, Azol, and Hitol, which simply call for dilution with water, all the developing agents need the addition of an alkali, which serves as an energizer or accelerator. Sodium carbonate is the alkali in general use everywhere today, although potassium carbonate is advised as an alternative offering advantages with certain developers, and the use of the caustic alkalies (sodium, potassium, and lithium hydrate) is called for by some of the "new" developers or metol substitutes now employed. The makers' formulas generally indicate the character of the alkali best suited to the developer.

The Restrainer

Practically the only restrainer used in modern development is potassium bromide, generally in very small quantities, viz., a few drops of a 10 per cent solution or a few grains of the salt. The present-day tendency is to discourage its use, or to use just the amount absolutely required to keep the plate from fogging and clear the shadows from possible veil.

Caution as to Sodas

To deal adequately with these salts and the part they play in the photographic process, discussing their nature, properties, functions, use and relative values in use, would interestingly fill a volume of several hundred pages. But it may suffice for our purpose here to advise the reader to insist upon "dry" or anhydrous sodas and chemicals of known and guaranteed purity in the preparation of his developers, following carefully the formulas advised by the makers of the plates or films in use, or those recommended by experience as best suited for particular purposes.

The Three Methods

There are three methods of developing negatives from which the reader may choose the one best adapted for his needs. (1) The tentative or visual inspection method, i. e., watching the plate or film as it develops, and judging the completion of development by the appearance of the negative. This was the only method in use up to twenty years ago, and it is still largely used by professionals and a few amateurs. (2) The factorial method, devised by Watkins, in which the time of development is judged by noting the time taken for the first appearance of the image in the developer and multiplying this by a predetermined number or factor. This method, an attempt to solve the big difficulty in tentative development, viz., when to stop development, has latterly been modified and improved in the Thermo system which, in turn, is constantly being modified or improved. (3) The time and temperature system, in which the development of the negative is done by placing it in a developing solution of known composition for a definite period of time at a given temperature. This includes the closed-tank and open-tank methods, and may as well be worked in a tray as in the old tentative method.

Their Use

The practice of all these methods is described in the following pages by men thoroughly acquainted with their practical advantages in everyday photography. Some of the methods call for a darkroom, or workroom equipped with a safelight, table and sink, with a water-supply. Others may be worked in any convenient room, if a darkroom is available for the placing of the plates in the tank. Nothing whatever has been said about the tank development of rollfilms, such as the amateur uses almost exclusively, since this system calls for nothing more than the necessary developing tank outfit and a careful following of the maker's instructions which accompany the tank. Much, however, of what is said concerning tank development in general may be read with profit by even these workers.

A Key to the Book For the convenience of the reader the book is practically arranged in three parts in the following order: (1) The time and temperature methods; (2) the factorial method; and (3) the tentative method, ending with a method of "instantaneous" development which, if really akin to any one of these, seems to fall into the "tentative" class.

Stand Development To many workers stand-development and tank-development mean one and the same thing. They are, however, different methods in principle and practice, and it may be well to draw the distinction here, at the outset, since we shall see later that the "open tank" method so largely used today in professional and commercial studios is a practical combination of the two.

In Practice Stand development, as introduced in 1882–1892 by Wratten and Wainwright, Meydenbauer and others, comprised nothing more than the simultaneous development of a number of exposed plates by placing them in a vertically grooved box or tank filled with an extremely dilute developing solution, and leaving them there until they were developed. The correlation of developer formula, time, and temperature, now deemed all-important, was then not considered at all. So long as the plates did not frill, fog, or stain by prolonged soaking, the duration of development mattered little and often extended over several hours. The plates were examined by visual inspection from time to time, at the convenience of the worker, and removed to the fixing bath as they reached the desired printing density. The method, having so little to commend it, found few followers and was speedily abandoned.

Principles of Tank Development

Modern tank development, on the other hand, offers a definite system based on scientific fact. This basic fact, brought out by Hurter and Driffield (THE PHOTO-MINIATURE No. 56), is that the truthfulness (or otherwise) of the photographic record, as expressed in the relationship between the densities of the negative and the light-intensities in the subject which they represent, is determined once and for all by the exposure, development simply determining by its duration the range of opacities or contrasts included in the negative. This, of course, runs contrary to the old-time belief that errors in exposure could be compensated for, or the gradations in the negative controlled, by tinkering with the developer, either by changes in its constitution or in the method of its use.

Practice

In tank development, as based on this principle, the exposed plates are placed in a tank previously filled with a developing solution of known strength and temperature, an air-tight and light-tight lid is clamped down on the tank, and the plates are left to develop automatically for a definite period of time, calculated to give the desired range of contrast with the plate in use, with the particular developer and temperature employed. The normal time of development at a temperature of from 62° to 65° Fahr. ranges from 10 or 15 to 20 or 25 minutes, according to the strength of the developer, the character of the plate in use, and the contrast desired in the negatives for this or that variety of printing paper.

Advantages

This method has many advantages and is slowly but surely taking its place as the standard development method for plates, flat films and roll films. Where a closed tank can be used, such as the Kodak film tank for roll films, the necessity for a darkroom is eliminated. There is no need for visual inspection or handling of the negatives during development; no puzzling question as to the right moment when to stop development or of errors in judging density. The process is largely automatic, simple, cleanly, economical, and more certain of producing a larger percentage of good negatives than the earlier hand-and-tray method. The protection of the negatives from the air during development obviates the troubles which arise from oxidation and light-fog, so that tank developed negatives are usually clearer, more brilliant and freer from veil and physical blemishes than those developed in a tray. Finally, there is the convenience and saving of time in the use of the method, by which we can develop six or twelve negatives in the same time and with less trouble than was formerly required for a single negative.

Suggestions

Volumes have been written concerning tank development, but if the reader has grasped the underlying idea and the practical simplicity of the method, the multiplying of words about it can only bring confusion. I will therefore only add that carefulness as to temperature is the vital point in the method; that in the case of closed tanks it is imperative to reverse the tank several times during development to prevent uneven action of the developer, or in the case of open tanks, the plates should be moved occasionally during development to set the development solution in motion for the same reason; and that it is always preferable to lower plates or films carefully and steadily (with uniform motion and without stoppage) into a tank already filled with developer, rather than to load the plates into the empty tank and then pour in the developer. It is also advisable to prepare the developing solution with water which has been drawn from the faucet an hour or two previous to development and allowed to stand so as to reach the temperature of the developing room before use.

Eastman Pyro Tank Developer

The pyro developer advised for use with the Eastman closed tank for plates is made up as follows: *Stock Solution A*—Water, 16 ounces; pyro, 1 ounce; oxalic acid (poison), 10 grains. *Stock Solution B*—Water, 16 ounces; E. K. Sodium Sulphite, 3 ounces. *Stock Solution C*—Water, 16 ounces; E. K. Sodium Carbonate, 1 ounce. For 30 minutes' development time at 65° Fahr., take of *A*, *B*, and *C* 1 ounce each and add 61 ounces of water.

Pyro-Acetone A formula advised for tank development of single-coated plates where halation is feared is made up as follows: *Stock Solution A*—Distilled or boiled water, 16 ounces; pyro, 1 ounce; sodium metabisulphite, 90 grains. *Stock Solution B*—Water, 20 ounces; sodium sulphite (dry), 2 ounces; acetone, 4 ounces. For normal subjects and development time 18 minutes at 65° Fahr., take of *A*, 1 ounce, of *B*, 2 ounces, and add 30 ounces of water. For subjects with strong contrasts of light and dark, interiors with windows or figures silhouetted against the light, reduce the quantity of *A* to 4 drams. This developer, like all developers including acetone, requires the tank to be reversed, or the developing solution frequently set in motion, to avoid marbleized streaking of the negatives. It is a fine hot-weather developer, i. e. anti-frilling, and does not stain the fingers more than M-Q.

Pyro-Metol A favorite tank developer with many professionals is that advised for Central plates, mixed half an hour before use (in the tank) from three stock solutions previously prepared as follows: *Stock Solution A*—Hot water, 18 ounces; oxalic acid, 20 grains; metol, 70 grains; sodium sulphite (dry), 2 ounces. When this has cooled add: Cold water, 6 ounces, in which 1 ounce of pyro has been dissolved. *Stock Solution B*—Water, 24 ounces; sodium sulphite (dry), 3 ounces (or 60° hydrometer test). *Stock Solution C*—Water, 24 ounces; sodium carbonate (dry), 2 ounces (or 40° hydrometer test). For tank development, 15 to 18 minutes at 65° Fahr., use: Water, 60 ounces; of Solution *A*, 2 ounces; of Solution *B*, 2 ounces; of Solution *C*, 1½ ounces.

Fredol-Pyro A reliable formula for tank development with Fredol (a typical paramidophenol sulphate salt) in combination with hydroquinone and pyro, is given as follows for 20 minutes' development at 65° Fahr. Water, 1 gallon; Fredol, 20 grains; sodium sulphite (dry), 1⅓ ounces; hydroquinone, 80 grains; sodium carbonate (dry), 1¼ ounces; sodium metabisulphite, 20 grains; pyro, 125 grains; potassium bromide, 4 grains.

Paramidophenol-Pyro For tank development with paramidophenol-hydrochloride (Gennert), in combination with hydroquinone and pyro the following is advised for 20 minutes' development at 65° Fahr.: Water, 1 gallon; paramidophenol-hydrochloride, 22 grains; hydroquinone, 32 grains; sodium sulphite (G. G. P. P.), 1½ ounces; sodium carbonate (G. G. P. P.), 1¼ ounces; sodium bisulphite, 36 grains; pyro, 36 grains, potassium bromide, 6 grains.

Paramidophenol-Hydroquinone For 20 minutes' development at 65° Fahr., take: Water, 1 gallon; paramidophenol-hydrochloride (Gennert), 30 grains; hydroquinone, 60 grains; sodium sulphite (G. G. P. P.), 1¼ ounces; sodium carbonate (G. G. P. P.), 1 ounce; potassium bromide, 3 grains.

Rodinal: Paranol: Citol These being chemically identical, concentrated paramidophenol-hydrochloride developers may be used for the tank development of plates or films as follows: Dilute 1 part Rodinal, Citol, or Paranol with 100 parts water. For landscapes develop 26 minutes; portraits, 20 minutes, at 65° Fahr. For plates of extreme speed, such as Sigma, continue development half again as long, and for double-coated plates add 5 minutes to the prescribed time as given.

Serchol-Hydroquinone In dealing with this British developer in The Photo-Miniature No. 167, I erroneously classed it as a sulphate salt of paramidophenol. According to later authoritative information, it is a cresol derivative, closely akin to but not identical with German metol. A tank developer with Serchol in combination with hydroquinone is made up as follows: Water, 36 ounces; Serchol, 6 grains; hydroquinone, 18 grains; sodium sulphite (cryst.), 1½ ounces; sodium carbonate (cryst.), 120 grains; potassium bromide (10 per cent solution), 10 drops. Develop 20 minutes at 65° Fahr.

Mitus Hydroquinone For 20 minutes' development at 65° Fahr., make up: Water, 1 gallon; Mitus, ½ ounce; hydroquinone, ¾ ounce; sodium sulphite, 5 ounces; sodium carbonate, 3 ounces; potassium metabisulphite, 80 grains; potassium bromide, 25 grains. After solution is complete, add water to make the bulk of the solution 5 gallons.

Glycin

A reliable glycin formula with remarkable keeping quality, giving fine-grained images, absolutely free from stain, is made up as follows: Water, 128 ounces; sodium sulphite (dry), 180 grains; sodium carbonate (dry), 180 grains; glycin, 120 grains. Time, 20 minutes at 65° Fahr.

The Eastman glycin tank developer is as follows: *Stock Solution*—Hot Water (about 200° Fahr.), 60 ounces; E. K. sodium carbonate (or desiccated), 2 ounces; Glycin, ½ ounce; E. K. sodium sulphite (or desiccated), ½ ounce. Dissolve in the order given. To develop take: Stock Solution, 6 ounces; water, 58 ounces. Develop 25 minutes at 65° Fahr., or 20 minutes at 70° Fahr.

Open-Tank System

The development method now coming into general use in professional and commercial studios is known as the Core open-tank system, being based on the use of a simple, but ingenious, metal plate rack or holder in connection with an open box or tank, invented by the late Fred Core, son of the famous photographer of children, E. B. Core, of New York.

Revolutionary in Practice

This system is effecting a veritable revolution in professional development practice, and has so many good features, where large numbers of plates or flat films are to be manipulated, day after day, that I propose to explain it in detail as a decided advance on all earlier methods. It covers the development, fixing, washing, and drying of plates or flat films, without any necessity for handling them during the operations, and is carried through in the darkroom, equipped with the usual safelights, sinks, and water-supply.

Simple and Practical

It is extremely simple, so simple that it permits of the use of unskilled helpers working under competent direction or supervision, without any impairment of the quality of the results. It is thoroughly practical, being based on sound theory (time and temperature with a given formula) and common sense, and has proved its complete efficiency under widely varying conditions in large commercial establishments, where hundreds of plates are developed daily. It has proved equally satisfactory in the small studio, where quality of results is the prime consideration, but where the number of plates to be developed daily will rarely exceed fifty exposures.

Its Economies

It effects a remarkable economy of working space, time, and materials, and is much more cleanly and convenient in practice than the old method of using large trays, or the later method of closed-tank development. Thus a single operator, with this system, can develop, fix, and put into the washing tank 150 negatives within an hour, and be more certain of good printing negatives than by the laborious hand-and-tray method taking three times as long—and, with a little care, need not wet his fingers in the process.

Elasticity of Method

It is extremely elastic in operation and can be employed as a strict time and temperature method, thus obviating the necessity of constant personal attention in the darkroom; or it can be worked (as it generally is worked) by the visual inspection method to which photographers are accustomed. It is equally adapted to plates or the new flat films now coming into use, or both.

Other Conveniences

It does away with stained fingers due to the use of pyro, although pyro is commonly used. Nor is there any necessity at all for keeping the hands or fingers immersed in alkaline or cold solutions, which opens up the field of darkroom work to women—a feature which should commend it in these days when "man power" is a difficulty.

The System Described

Briefly described, the system calls for a number of stoutly built wooden tanks, wide enough and deep enough to take the largest plates in use. These should have movable crossbars, capable of being placed at any desired position to subdivide a tank when used for the development of small plates. The tanks should be lined with sheet copper, which should overlap the top edges of the tank, and all exposed wooden parts and crossbars should be given two coatings of an acid- and alkali-proof paint, such as Probus or Mogul, which should be renewed from time to time.

Development Tanks

For convenience, the developing tanks should be made of such a size as to take not more than fifty plates in the racks or kits to be described later. Such a tank for 5 x 7 plates will call for several gallons of developing solution. A wooden, floating top, which will rest on the top of the solution just within the tank, will serve as an air-excluding cover when the tank is not in use.

Fixing Tanks

The fixing and washing tanks, similar in all details to the developing tanks, may be made to take 100 or 200 plates in their racks, according to the accommodations offered by the darkroom, as they are stationary. All tanks, when in constant use, should be vigorously scrubbed every other week or so with a dilute solution of muriatic acid, to ensure perfect cleanliness in working.

Plate Racks

The racks, or kits, or holders, which hold the plates or films securely in a vertical position through all the operations, are supplied by the Eastman Kodak Company. They consist essentially of a metal frame having two grooved sides into which the plate or film is slipped and held. This frame is about 1½ inches larger from top to bottom than the narrow way of the plate or film for which it is intended, and the top bar of the frame extends about an inch at each side, so that when the plate is suspended vertically in the tank, this top bar rests upon the edges of the tank. This device takes the place of the old-time grooves in the tank, and enables one to insert or remove a plate or film (in its rack) at any time without putting one's fingers into the developing solution. Also by a slight movement of the hand across the top frames of the racks in the tank, one may set the developer in motion at any moment.

How the System Works

The working method followed where this system is in practical use is, as I have said, extremely simple, and makes for the utmost efficiency of result with the largest possible economy in time and labor. The darkroom equipment should first be arranged for the smooth working of the system, with a view to the quick handling of large numbers of plates.

A Typical Instance

Thus, in a typical instance, I recall a darkroom about 10 feet square, facing north, where from 50 to 100 plates were developed daily between 5 and 6 P.M. A capacious, lead-lined sink, about 12 inches deep and 30 inches wide, ran across the width of the room at the north wall. Left of the center of the north wall was placed the safelight; at the right were two faucets, one connected with the two washing tanks (holding 50 plates apiece in their racks), placed in the extreme right-hand part of the sink, and the other providing the general water-supply. The washing water ran into the washing tanks at the far end and left the tanks by an outlet near the bottom of each tank, thus ensuring a complete change of wash water at all times. On the rear, top edge of the sink, over the washing tanks, was placed the fixing tank, also holding 50 plates in their racks.

Plates and Racks

Along the west or left-hand wall of the room ran a shelf about 15 inches wide. Half of this was taken up by a light-proof cupboard or enclosure, in which were stored the day's stock of exposed plates as taken from the plate holders. The remainder of the shelf served as a table for the transfer of the exposed plates to the racks. These latter were hung on long pegs on the wall about the shelf, each peg holding five racks, suspended by a corner all ready for use.

Developing Tanks

Across the top of the sink, at the left of the safelight, were placed two developing tanks. An hour or two before the time for the development of the day's exposures, the required developing solution was made up, poured into the tank or tanks, according to the day's need, and allowed to stand so as to reach the room temperature—maintained as near 65° or 67° Fahr. as possible. The fixing bath was made ready for use, and a tank filled with clean water placed in the sink at about its center, to the right of the developing tank. Care was taken to have all the solutions at a temperature uniform with that of the room and as near 65° Fahr. as possible. This uniformity of temperature is a vital point.

Handling the Plates

When the time for development came, the operator, working comfortably in the safelight provided, opened the whole front of the cupboard containing the exposed plates and set ready on edge, on the shelf nearby, about 50 empty racks from the supply on the wall. Taking a rack in his left hand, an exposed plate was taken from the cupboard with the right hand and inserted in the grooves of the rack held in the left hand. Rack and plate were now placed on edge on the shelf, and this filling of racks continued until all the exposed plates were in racks. The surface of each plate, in its rack, was next carefully dusted with a flat camel's hair brush (this detail being emphatically condemned by other operators) and the plate, in its rack, at once placed in the tank of clean water. (This preliminary soaking in water is also condemned by many workers.) As soon as the plain water tank had been filled with plates treated as described, they were transferred (three or four at a time), in their racks, to the development tank, so that all the plates are put into the developing solution at practically the same moment. If the development is done on a strict time and temperature plan, the time of suspending the plates in the developer is noted, and at the end of the development period they are quickly transferred to the plain water tank, and again removed to the fixing bath. When fixed they go into the washing tanks, from which they are finally removed and suspended to dry (still in their racks) on pegs on the wall, kept apart to permit access of air for drying purposes. An electric fan, fixed beneath the suspended racks and plates, may be used to facilitate the drying of the negatives. If the equipment does not include a fan, the plates are left to dry over night.

Variations in Practice

The scheme is much simpler in practice than it reads. Experienced operators, who dust their plates before placing them in the plate holders of the camera, and who maintain cleanliness in the darkroom, eliminate the use of the darkroom brush and preliminary soaking and simply transfer their exposed plates to the racks and immediately place them in the developing solution. Such men often work by the visual-inspection-during-development method, so that by the time they have placed the last of the exposed plates in the developing tank, those first inserted are almost ready for transfer to the rinsing or plain water bath and thence to the fixing bath. These workers always take the precaution to pass a strip of clean blotter over the top of the developing solution, to remove any dirt particles or scum, before putting plates to develop, and are careful to see that the developing solution is thoroughly mixed so as to be of the same strength throughout. Another point requiring care, where this method of putting dry plates or films into the developer without preliminary soaking is followed, is that the plates (in their racks) must be lowered steadily and quietly into the solution to avoid the formation of bubbles or airbells on the plate surfaces, such as are caused by a hurried or rough motion in placing the plates in the developer.

Even Development

During development by this method it is necessary to rub the hand gently along the tops of the racks two or three times (at intervals), so that the developing solution is quietly agitated or set in motion, and its action kept uniform throughout the tank. This swings or rocks the plates in their racks and is equivalent to the reversal of the closed tank in that method, preventing the streaking or uneven development of the negatives, resulting from the greater density of the lower strata of a developing solution which is allowed to stand undisturbed for any length of time. After one or two batches of plates have been put through on this schedule, the operation of the method is simplicity itself, and the results are plainly seen to surpass those secured by the old-time tray method, so that no one who has adopted the open tank method has been known to return to the use of trays.

Vital Points

In the successful use of this method, two or three important principles must be kept in mind. First, that cleanliness everywhere is essential—clean tanks, clean solutions, clean racks, clean shelves and plate cupboards. Second, that temperature is the vital point of the system. It must be uniform, and always between 62° and 68° Fahr., with 65° as the point giving the best results. See to the room temperature and ensure your working solutions being at the same temperature by making them up beforehand and allowing them to stand in the room until needed for use. Third, remember that the density (or range of contrast) in your negative is controllable by the amount of sodium carbonate (or other alkali) employed, which influences the speed of development and development time. This will be varied at different seasons. In other words, the range of contrasts in your negatives will vary, with a given development formula and time of development, according to the proportion of sodium carbonate. Similarly, the color or printing quality of your negatives is controlled by the proportion of sodium sulphite used.

Balancing the Developer

The balancing of the developer can be determined in practical use only, according to the individual ideas of the photographer, who knows the kind of negatives he needs, to get the particular sort of prints he desires with the printing paper in use. This balancing of the developer must also take into consideration the general character of the plate in general use, since no one formula will give the best possible negative on any or every kind or make of plate. For this reason many photographers make up their developer in three separate solutions—pyro, sulphite, and carbonate, adding to the quantity of water in the developing tank just the proportionate amounts of each needed to give them the kind of negatives they want in a given time and at a given temperature. The character of the subject is also a factor in this balancing of the developer. Photographers who use dark backgrounds and work in a generally low scale of tone values will obviously use a developing solution different from that used by another photographer who works with light grounds and in a narrow scale of high tone values. Similarly in view and commerical work, the makeup of the developer will be varied according to the general character of the subjects in hand for treatment.

The Sodas Apart from this elasticity of control by balancing the developing solution, it is important to insist on the quality of the sodas, sulphite, and carbonate. The use of "dry" sodas, or sodas of reliable brand and in perfect condition, will materially help in the getting of good results, and the uniform use of a known brand or strength is equally important. Most of the failures and undesirable variations in the quality of negatives experienced in professional studios are directly due to carelessness in this detail. See that you use only clean solutions, made up of chemicals of known strength and quality; look to the temperature at time of use, and you will not have to complain of your methods or results.

Using Developer Repeatedly The developing solution used in the open-tank method, whether pyro or one of the "new" developers be used, can be used for repeated development if care is taken to strengthen the bath by the addition of fresh developer as needed, so that it will work at the predetermined time and temperature. To prevent oxidation of the solution when not in use (it is generally left in the tank), a floating cover of wood made to fit inside the top of the tank and lie on the surface of the developer is generally used and has proved effective. This also prevents evaporation and keeps dirt from getting into the developer.

Eastman Open-tank Formula A typical and thoroughly good developer for use with the open-tank method is that recommended for Eastman Portrait, Commerical, and Ortho. Films. This is based on the use of a neutral sulphite obtained by the combination of sodium sulphite and sodium bisulphite, as follows: Pyro, 1 ounce and 85 grains; E. K. Co. sulphite of soda, 6 ounces and 175 grains; sodium bisulphite, 1½ ounces; E. K. Co. carbonate of soda, 2 ounces; Potassium iodide, 5 grains; Water up to 1 gallon.

The following instructions *must* be strictly followed, as the keeping qualities of this developer depend entirely upon the method of preparation.

Dissolve the sulphite first in 1 quart of hot but not boiling water. When dissolved, add the bisulphite and then *boil* the solution for 5 minutes. Cool to about 70° Fahr. and add the pyro. Dissolve the carbonate in 1 pint of warm water, then add the iodide. Pour these two solutions into the tank and make up to 1 gallon of water.

The most satisfactory temperature for developing is 65° Fahr. The solution should not be used below 60°. When the developer is first made and used, the developing time at 65° Fahr. is about 18 minutes.

After the developer has been used for several batches of plates or films, it will be necessary to strengthen it with the addition of each new batch. The strengthening solution is made by dissolving the chemicals named in the following formula and using exactly the same method for preparing it, as when preparing the first developer.

Strengthening Bath Formula

Pyro, ¼ ounce; E. K. Co. sulphite of soda, 1 ounce and 150 grains; sodium bisulphite, 150 grains; E. K. Co. carbonate of soda, 3 ounces and 50 grains; potassium iodide, 4 grains; Water up to, 60 ounces.

Add this strengthener to the developing solution in the tank as needed, to keep up the developing strength of the solution as this decreases in use.

Fixing, etc.

The fixing bath may be made up as follows: *A*—Water, 96 ounces; hypo, 2 pounds; E. K. Co. sodium sulphite, 2 ounces. *B*—Water, 32 ounces; chrome alum, 2 ounces; sulphuric acid, C. P., ¼ ounce. Pour *B* solution into *A* solution slowly while stirring *A* rapidly. This bath will last for days if plates only are fixed in it; but a fresh bath must be prepared daily if films are used, as the gelatine-coated backs of the films are likely to become stained in an old or discolored fixing solution.

After thorough fixing in this bath, the plates or films, in their racks, should be washed for 10 minutes in running water. After washing, plates may be suspended to dry in their racks as already mentioned. Films should be removed from their kits (slightly different from the plate racks), laid down on a piece of wet glass, and swabbed, front and back, with a tuft of wet cotton, then rinsed under the tap and suspended to dry, by means of a wooden clip, by an edge or corner, on a convenient line in a current of air away from dust.

Waktins' Factorial System

We now come to a brief consideration of the "Factorial" System of development, introduced by Mr. Alfred Watkins. The principle of this method is that, for every developing solution, there is a definite proportion between the time required for the highlight to appear on the plate and the time required for the plate to reach some chosen standard of density or contrast. For example: Suppose, with a pyro-soda developer, the image begins to appear 30 seconds after pouring on the developer and reaches the required density in 4½ minutes (270 seconds). In other words, the total time of development is nine times the time of appearance of the image, and we can use this number, or factor, for ascertaining the total time of development when the image appears in a longer or shorter time, *as the result of using a different plate or working at a different temperature*, and when aiming at the same degree of contrast. Thus, if the time of appearance is 50 seconds, the total time of development will be 50 × 9 = 450 seconds, or 7½ minutes. The words italicized above require to be especially noted, because the system works effectively only when the plate has been correctly exposed or approximately so.

The Method in Practice

We have to develop, say, half a dozen plates (they may be different makes) in exposing which we have used a meter and made sure of reasonably correct exposure. We are developing with rodinal, the factor of which for average contrast is 40, rodinal being a developer which brings out the image quickly, but requires a relatively longer time to give density. The image begins to appear in, say, 12 seconds. That means that the total time of development is 12 × 40 = 480 seconds = 8 minutes. A neat form of calculator is supplied by the Watkins Meter Company for dispensing with arithmetic in the darkroom, but a really more practical plan is to write out in bold figures a table giving the total times of development for various times of appearance, e. g., for rodinal.

Time of Appearance: *Seconds*	5	6	7	8	9	10	11	12
Total Time of Development: *Minutes* . . .	3¾	4	4¾	5¼	6	6¾	7¼	8

Cover up the plate and let it develop with an occasional rocking until the prescribed time is completed.

Several Plates at a Time

But usually, as in our present case, we have several plates to develop. Have any ordinary clock going somewhere in the darkroom where it is easily seen. Use it only for telling when to take out the plate. For timing appearance of the image, the best thing is a stop-watch, which can be set going by one pressure, stopped by another, and brought back to starting-point again by a third. Make a note of the time by the clock, pour on the developer and at the same time start the stop-watch. As soon as the image appears, stop the watch, note the number of seconds and, from a look at the table, see how long the plate must be kept in. Then add on that time to the previous note, and you are ready to go on with the next plate.

This all sounds horribly distracting in cold print, but it is soon second nature in the darkroom. Thus:

Time of appearance, 12 seconds; time by clock at start, 7.20.
Development time for factor 40, 6 minutes; add 6 minutes.
Take out plate at 7.26.

You see that, within half a minute, you are free to develop the next plate, and in this way can quite easily keep five or six plates in hand, which usually is as many as one wants at a time.

Developer Factors

Mr. Watkins and some few others have published factor figures for various developers. Let us be clear what these figures mean. They are factors chosen for the purpose of yielding, when the system is used, negatives having a medium degree of contrast. Thus a low figure (short factor) of 5 is chosen for hydroquinone, whereas metol has one of 30 assigned to it. Ordinary experience tells us that hydroquinone is a developer which quickly piles on density, once the image has come out; whereas metol brings the image out quickly, but is slow in giving density. The use of particular factors enables us to employ developers with a fairly high degree of certainty as regards the vigor of the negative. As in "time" development, it is well to make one or two preliminary trials of the developer in order to fix upon the factor which gives the sort of negative required.

Finding the Factor

In doing this, proceed as already directed in time development, but note also the time of appearance of the image in the case of each of the three negatives. Note also the total time of development. Then, by dividing each total time by its respective time of appearance, you will get a series of three factors from which you can choose for regular work according to the negative.

Some Factors

In the case of most developers, the effect obtained by the use of a given factor does not vary with the strength of the developer. If a weaker developer (more water) is used, the time of appearance is longer; but, if development be continued as indicated by the factor, the result corresponds with that obtained in the same way with the stronger form of the formula. Factors for negatives of average vigor are as follows: Hydroquinone or adurol, 5; metol, 30; rodinal, 40; glycin, 8 to 12; eikonogen, 9. In the case of pyro and amidol, the factor varies according to the strength of the solution in the developer proper, e. g., pyro soda (without bromide) has factors as follows:

Pyro grains per ounce of working developer	1	2	3	4	5½
Factor	18	12	10	8	6

Amidol (or Acrol, Diamidophenol or Dianol) varies in the same way according to the strength (in amidol) of the working solution. In other words, these developers, when used strong, are of a short-factor type like hydroquinone but, when used weak, are of the long-factor soft-working type, more akin to metol or rodinal. In theory it doesn't matter, so far as the density and vigor of the negative are concerned, which type of developer you use, so long as you develop for the right time. While this is broadly true, it must be remembered that it is true only when exposure has been reasonably correct. If a plate is over-exposed, there is a great advantage in using a short-factor developer; if under-exposed, a long-factor. Pyro, with its range of factors, according to dilution, no doubt owes its supremacy largely to this duplex character.

Some Factorial Cautions

I have said that temperature is compensated for by the factorial system; and so it is in the sense that the system holds good for developing solutions of any temperature from 45° to 75° Fahr. But the system does require that the developer remain at the same temperature through the whole period of development. If the solution is 65° at the start, and gradually drops to, say, 50° in a chilly darkroom, it is obvious that the action will fall off toward the end, and the negative be less vigorous than it should be. Conversely, a developer which becomes gradually warmer will yield too much vigor.

Another point to bear in mind is that there should be enough and to spare of the developing substance in the quantity of solution used on the plate. Mr. Watkins takes 2 grains of pyro as sufficient to leave a margin for a quarter plate (3¼ x 4¼ inches), which means that, when using a weaker developer, proportionately more of the solution should be taken; e. g., 4 ounces of developer containing half a grain of pyro per ounce of solution. This is a point of which it is easy to lose sight. Also remember that developer is used up by its own action on plates. For this reason, pyro and amidol developers should not be used twice, as the once-used solution has a smaller factor, though how much smaller there is no means of telling. Other developers can be used several times in succession.

Thermo Development

The Thermo System is a modification of this Watkins Factorial System which has won favor on this side of the Atlantic. A card, giving at a glance the formulas and tables essential in its use, may be obtained for 25 cents from the American Photographic Publishing Co., Boston. These were republished in THE PHOTO-MINIATURE No. 139, now out of print. See, also, Dr. Miller's article n the "American Annual of Photography," 1915.

Plane Development

This method was suggested by Rudolf Walter in 1906, and heartily endorsed by Dr. Neuhauss as an improvement upon the early process of "stand" development which preceded the method of "tank" development in use today. It attracted favorable attention when first introduced, but seems to have been forgotten, possibly because it is, in practice, a somewhat tedious process of developing plates separately. I give it place here as offering special advantages in the development of difficult subjects including strong contrasts, e. g. interiors showing brilliantly lighted windows, night scenes with strong highlights, landscapes with sunlight and deep shadows, and copies of engravings.

In Practice

Briefly described, the method is as follows: Provide a box with a light-tight cover, about 4 inches in depth, and the inside painted black. In this is placed the developing tray, large enough to accommodate as many plates as are to be developed. The box and developing tray are now carefully leveled, the plates dusted and placed in position, and the developer poured on evenly and without rocking or the formation of bubbles, after which the cover is put on. Any slow-working, non-staining developer may be used, von Hubl's glycin stand developer, diluted 1:40, being advised. After half an hour the plates may be inspected, but with care not to shake the tray or otherwise agitate the developer. A porcelain tray is best, as permitting inspection without disturbing the plate. As development is seen to be complete (rarely longer than 1½ to 2 hours) each plate is removed, rinsed and fixed as usual.

Principles Explained

The theory of the method is explained as follows: When a plate is exposed, where the light falls, there is formed silver sub-bromide; after exposure we have then silver bromide and sub-bromide in the film. During development the sub-bromide is reduced to metallic silver and bromine is set free. The latter combines with the alkali in the developer to form alkaline bromide. In the ordinary methods of development the bromide formed is equally distributed throughout the developer. The presence of bromide in the developer checks the reduction of the silver sub-bromide to metallic silver. For this reason bromide is usually added in development in cases of over-exposure. This restraining action is exercised in the shadows as well as the highlights, for the bromide is by the rocking of the dish evenly distributed throughout the whole of the developer. In these methods of development, therefore, the retardation of the silver reduction is equally distributed over the whole of the plate, and a partial action on the reduction of the silver in places where it is desirable is unattainable. Stand or tank development shows the same fault, for the bromide formed slowly sinks in consequence of its specific gravity to the bottom.

There is therefore nothing left but to place the plate film up in an absolutely leveled dish, and after pouring on a weak developer, to leave it undisturbed. With this method of development the bromine set free in the most exposed parts of the plate sinks down as sodium or potassium bromide and remains there, as the plate is not rocked or disturbed till development is finished, and thus acts as a special restrainer at these places, especially as the bromine "in statu nascendi," appears to act more energetically than when it is added drop by drop as bromide to the developer.

Local Restraint

The restraint of the development is regulated by this process in the most correct way, for in the shadows, where little bromine is set free, there is no or very little restraining action. In the highlights, on the other hand, there is strong restraining action. The result is, that not only is the negative more even than when the ordinary method of development is used, but also over-exposure or halation is almost completely compensated for in practice.

Wallace Time and Temperature Method

I republish here, as too valuable to be lost by inaccessibility, the time and temperature method of development worked out by W. H. Wallace a few years ago. This method is thoroughly sound in principle, extremely simple in use, and intensely practical. It consists essentially of a formula for the developer and a table giving the time and temperature at which this developer will give negatives of any desired printing quality (density), the contrast factors being expressed in black-face figures at the head of the table. The time of development is given in minutes and seconds, varying with the temperature and the amount of contrast desired. This latter is determined by the individual worker, to suit the printing paper employed or his own taste as to the character of negative required.

With Pyro

The first formula and table are for use with pyro in the development of large batches of plates in a tray. Prepare stock solutions as follows: *A*. Water, 24 ounces; sodium carbonate (dry), 1 ounce; sodium sulphite (dry), 1 ounce. *B*. Water, 9 ounces; oxalic acid, 12 grains; pyro, 1 ounce. Use only boiled (cooled) or distilled water in making up these stock solutions. For normal exposures, with temperatures below 68° Fahr., mix *A*, 6 ounces; *B*, ½ ounce. With temperatures higher than 68° Fahr., dilute this mixture with an equal bulk of water for use.

Method of Use

In use, knowing the temperature of the working solution, which should be uniform with that of the room, trays, etc., find this degree of temperature in the column at the left-hand side of the table, and at the intersection of the horizontal line with the vertical line leading up to the contrast factor in use (previously determined) will be found in minutes and seconds the length of time to develop at this temperature. To illustrate: Suppose that we determine to use contrast factor 6 as giving us the desired range of contrasts in our negatives, and that the temperature is 66° Fahr. At the intersection of the lines 66 and 6 in the table will be found the figures 4 and 05, indicating the time of development as 4 minutes and 5 seconds. This is all we need to know. The plates are immersed in the developing solution in the tray, and at the end of the indicated time are taken out, rinsed under the tap, and placed in the fixing bath. There is here no need for visual examination or perplexity as to when to stop development. If the contrast factor has been chosen intelligently for its purpose and the temperature is uniform throughout, the results will be all we desired. The choice of the contrast factor depends upon the printing paper and can be determined in a few trials.

Time and Temperature Table for Use with Wallace's Pyro Formula, the Time of Development Being Given in Minutes and Seconds.

Temp. Fahr.	CONTRAST FACTORS												
	4	4½	5	5½	6	6½	7	8	9	10	11	12	13
59°	3min. 55 sec.	4 25	4 55	5 25	5 55	6 25	6 55	7 50	8 50	9 50	10 50	11 50	12 50
60°	3 30	4 00	4 25	4 50	5 20	5 45	6 10	7 05	7 55	8 50	9 45	10 35	11 30
62°	3 15	3 40	4 05	4 30	4 55	5 20	5 45	6 30	7 20	8 10	9 00	9 50	10 40
64°	3 00	3 20	3 45	4 05	4 30	4 50	5 15	6 00	6 45	7 30	8 15	9 00	9 45
66°	2 45	3 05	3 25	3 45	4 05	4 25	4 45	5 30	6 10	6 50	7 30	8 10	8 55
68°	2 30	2 50	3 10	3 30	3 50	4 05	4 25	5 05	5 40	6 20	7 00	7 35	8 15
70°	2 20	2 35	2 55	3 10	3 30	3 45	4 05	4 40	5 15	5 50	6 25	7 00	7 35
72°	2 10	2 25	2 40	2 55	3 10	3 25	3 45	4 15	4 50	5 20	5 50	6 25	6 55
73°	2 00	2 10	2 25	2 40	2 55	3 10	3 25	3 50	4 20	4 50	5 20	5 50	6 15
75°	1 50	2 00	2 15	2 25	2 40	2 55	3 10	3 35	4 05	4 30	4 55	5 25	5 50
77°	1 40	1 50	2 05	2 15	2 30	2 40	2 55	3 20	3 45	4 10	4 35	5 00	5 25

With Metol-Hydroquinone The second formula and table are for use with metol (or Monomet or Metol-Johnsons) and hydroquinone combined as a developer for plates or flat or roll films in tray or tank. The formula is also adapted for the development of bromide and development papers and lantern slides, so that it is, in fact, a universal developer. Prepare a stock solution as follows: Dissolve sodium sulphite (dry), 4 ounces, and sodium carbonate (dry), 6 ounces, in 100 ounces boiled (warm) water; add metol (or equivalent substitute), ¼ ounce; hydroquinone, ¾ ounce; and finally add water to make the bulk of the solution up to 120 ounces.

Method in Use For general use with the table in the tray development of negatives, take equal parts of this stock solution and water, or dilute as desired when the action of this normal developing solution has been noted with the particular plate in use. The choice of the contrast factor, as before, lies with the individual worker and may be varied according to his requirements. As a guide, factor 5, the result of development for 3½ minutes at 66° Fahr., gives a negative of correct density for special Velox paper, while factor 7 is better adapted for the production of negatives suitable for platinum printing.

In Tank Development To use this formula for tank development: First, reduce to seconds the time of development desired. Second, reduce to seconds the time which the table shows will give the desired contrast with the full strength solution. Third, divide the first figure by the second and the resulting figure will give the dilution required for the prolonged development. Example: It is desired to use the formula for 20 minutes' development: 20 minutes = 1,200 seconds. The factor 4 is chosen, and temperature 68° Fahr., at which the time of normal development is indicated in the table as 2 minutes and 30 seconds = 150 seconds. Dividing 1,200 by 150, we get 8, indicating that for tank development, giving the desired contrast in 20 minutes, we must take 1 part of stock solution developer and add 7 parts of water. In order to avoid stain, the entire bulk of dilute developer used should contain 20 grains sodium sulphite per ounce of solution. To insure this, add 20 grains of sulphite to each ounce of water added to the bulk solution. Do not use at a temperature higher than 65° Fahr.

Time and Temperature Table for Use with Wallace's Metol-Hydroquinone Formula. The Time of Development Is Given in Minutes and Seconds.

Temp. Fahr.	CONTRAST FACTORS									
	1	2	3	4	5	6	7	8	9	10
59°	2min. 06 sec.	2 48	3 30	4 12	4 54	5 36	6 18	7	7 42	8 24
60°	1 54	2 32	3 10	3 48	4 26	5 04	5 42	6 20	6 58	7 36
62°	1 42	2 16	2 50	3 24	3 58	4 32	5 06	5 40	6 14	6 48
64°	1 36	2 08	2 40	3 12	3 44	4 16	4 48	5 20	5 52	6 24
66°	1 30	2	2 30	3	3 30	4	4 30	5	5 30	6
68°	1 24	1 52	2 20	2 48	3 16	3 44	4 12	4 40	5 08	5 36
69°	1 18	1 44	2 10	2 36	3 02	3 28	3 54	4 20	4 46	5 12
71°	1 12	1 36	2	2 24	2 48	3 12	3 36	4	4 24	4 48
73°	1 06	1 28	1 30	2 12	2 34	2 56	3 18	3 40	4 02	4 24
75°	1	1 20	1 40	2	2 20	2 40	3	3 20	3 40	4
78°		1 12	1 30	1 48	2 06	2 24	2 42	3	3 18	3 36

For Papers

In using the formula for the development of development or gaslight papers, use the stock solution at its full strength for regular papers, and use equal parts of stock solution and water for special papers. To insure clear whites, add one drop or more of a 10 per cent solution of potassium bromide to each ounce of the stock solution used.

Equivalent Times at Different Temperatures

The practical photographer who uses the tank method of development, already referred to, in his daily practice, knows by experience the time and temperature required, with his favorite developing solution, to give him just the sort of negatives demanded by the printing paper generally employed in order to yield the particular quality he desires in his prints. He also knows that the time of development must be increased or decreased with every decrease or increase in the temperature of his developing solutions. But, as a general thing, he must guess at the change in time required when his thermometer indicates a change in temperature.

Alves' Table

The following table, devised by Gaston M. Alves, shows at a glance the equivalent times, in minutes and half minutes, required to reach any given density at different temperatures between 60° to 72° Fahr.

Deg's	Minutes																
60	13	13½	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
61	12½	13	13½	14	15	16	17	18	19	20	21	22	23	24	25	26	27
62	12	12½	13	13½	14	15	16	17	18	19	20	21	22	23	24	25	26
63	11½	12	12½	13	13½	14	15	16	17	18	19	20	21	22	23	24	25
64	11	11½	12	12½	13	13½	14	15	16	17	18	19	20	21	22	23	24
65	10½	11	11½	12	12½	13	13½	14	15	16	17	18	19	20	21	22	23
66	**10**	**10½**	**11**	**11½**	**12**	**12½**	**13**	**13½**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**
67	9½	10	10½	11	11½	12	12½	13	13½	14	15	16	17	18	19	20	21
68	9	9½	10	10½	11	11½	12	12½	13	13½	14	15	16	17	18	19	20
69	8½	9	9½	10	10½	11	11½	12	12½	13	13½	14	15	16	17	18	19
70	8	8½	9	9½	10	10½	11	11½	12	12½	13	13½	14	15	16	17	18
71	7½	8	8½	9	9½	10	10½	11	11½	12	12½	13	13½	14	15	16	17
72	7	7½	8	8½	9	9½	10	10½	11	11½	12	12½	13	13½	14	15	16

Its Use Explained

The use of the above table will require little explanation: While 66° for the developing solution may be taken as the standard, it is not always easy or convenient to get that exact temperature. As already pointed out, we may use a range of from 60° to 72°, if we make the proper allowance in time. The table gives this allowance. For instance: Suppose we are working with a solution of such strength that it takes just 18 minutes at a temperature of 66° to properly complete the development, but we find the temperature of our solution to be 62. What time are we to allow for the development? Over 18 minutes and in the line of 62° we find 22 minutes, as the proper time.

How Computed

The table above is computed upon the following basis: Repeated experiments show that within the practical temperatures of development, a rise of 14° Fahr. will decrease the time of development about one-half, and conversely, a fall of 14° will about double the time of development. This natural law offers the means of determining the geometrical ratio in the sliding scale of all of the temperatures. Of course in working out this ratio, small fractions of a minute occur. In the table these were carried to the nearest ½ minute, and will produce no appreciable difference in results. The photographer may work without the table if he will carry in his head the following: Beginning with 7, the time rises by half minutes to 14, and from 14, by whole minutes to 28. If one uses a basic time of 18 minutes or over, and will never employ a temperature over 70°, both of which are good practice, then all one has to remember is, that for every degree less than the 66, one is to increase the time 1 minute; and that for every degree more, to decrease the time by 1 minute.

Brush or Local Development

Scientific theories and "new-fangled doctrines" aside, the reader who possesses a comfortable, safe-lighted darkroom, some little patience, and a definite knowledge of what he wants in his prints of a given subject, will find interesting possibilities in local development. In this method everything depends on "the man behind."

There is nothing difficult about it, but you must have a clear idea of the result you want to accomplish, and there will necessarily be a few failures—messy failures—before you "get the knack" of skillful handling required. The method is used by portraitists to control masses of white drapery or to accent the lights in a figure portrait, and by amateurs to control the different portions of an outdoor scene, e.g. to accentuate the lighting in any desired plane of the subject, to hold back the sky portion, or to get a generally harmonious negative from an unevenly illuminated subject.

Phillips's Brush Method

A successful professional worker, Ryland W. Phillips, describes his method of manipulation as follows. He uses the familiar A. B. C. Pyro developer in which the pyro, sodium sulphite, and sodium carbonate are dissolved and kept in separate stock solutions.

"I make up two forms of solutions, one the regular 1 ounce of each of the stock solutions A, B, and C, to 8 or 10 ounces of water, as you would in ordinary tray development; the other, separate the carbonate from the pyro and sulphite by making up a solution in regular quantities of pyro and sulphite with the regular amount of water. Then use a solution of one-half carbonate and half water, or two-thirds carbonate and one-third water, whichever you find will suit for the strength of the negative desired. Now, we will suppose you have your negative exposed with a subject in white drapery. You develop the plate in the regular developer until your general composition is apparent on the surface of the plate, then pour off this developer and *wash the plate*. Now pour on the pyro and sulphite solution which you have previously made up, and hold the negative up to the light in the hand, *flat*, then use a brush, or plug of soft cotton in a glass tube, saturated with the carbonate solution, and rub over that portion of the negative which you wish to bring out the most prominently. This must be done the first time very quickly, placing the negative immediately back in the pyro-sulphite solution, and then repeat the operation, blending the carbonate well over the plate so as not to get streaks.

"There is no special method of manipulation which will suit all cases. Each individual worker will have to experiment in his or her own particular way for his or her own particular result. The principle involved is this: The negative is developed only to a slight extent in the first immersion, and as soon as the pyro and sulphite solution is poured on, development practically ceases. Then you control the accent of highlights absolutely with your carbonate solution. Considerable practice will have to be had in most cases before you become master of this form of local work. I should caution the beginner to use under-timed rather than over-timed negatives for brush development, as the full-timed negative is much harder to control. In developing a 6 x 8 or 8 x 10 plate, I use a 1-inch camel's hair brush for the first brushing, going all over the plate with this, twice over the parts I wish to accent to once over the other part of plate. Then a brush less than half the size, also of camel's hair, can be used for pointing up."

Yellott's Method

Osborne I. Yellott, an enthusiastic amateur of the "eighteen nineties," preferred the use of three developing solutions of different strength in his practice and, confessing to having spent a full hour in the development of a single plate, apparently employed a non-staining developer. I quote: "I first make up a sufficient quantity of strong developer, say 12 ounces. This I divide into three portions. One portion is to remain in its normal, concentrated form; another is diluted with an equal bulk of water, and the third portion is diluted with from 12 to 16 times its volume of water. For a 5 x 7 negative a fine camel's hair brush and a supply of absorbent cotton complete the equipment.

Manipulation

"Now let us take the average outdoor subject: a landscape with clouds, an uninteresting foreground, a straight road with well defined wagon tracks, a range of hills in the middle distance with higher mountains behind them, the scene illuminated by noonday sunlight. Instead of developing this plate in the ordinary, full-strength, or even half-strength developer, we place it in our very weak bath. In a minute or two the image will begin to come out, gaining density slowly. After about 5 minutes of this kind of development, during which the sky is gaining but a tithe of the density it would gain in the normal developer in that time, we dip a wad of absorbent cotton in the half-strength solution, and carefully take it up and down the road. This is repeated several times, giving the near end of the road less forcing than that nearer the middle of the picture. Then put the plate back in the weak developer. Now we take our brush, dip it in the concentrated solution, and paint with it any prominent object in the foreground which will give desirable emphasis, being careful to keep within the outlines, placing the plate back in the weak solution from time to time, or rinsing and draining, if necessary, to keep the developer from spreading. Next take the wad of absorbent cotton, wet with the half-strength solution, and run it boldly over the central portion of the picture, including the hills in the middle distance, and later the mountains behind them, using the brush with the latter. Continue this treatment cautiously until the plate has almost reached its proper printing density, centering the highest tones somewhat but carrying the forced development to the edges of the plate, though in a less degree, and replacing in the weak developer frequently to avoid spotting and streaking. Next pour off the weak solution, and then flood the plate for a few seconds with the stronger, or even the strongest, if it is still lacking in density. The sky will now come up rapidly. As soon as it is dense enough to print of the desired tone, pour off the developer, rinse and fix the plate."

Pyro for Unknown Exposures

Where large quantities of plates which have received varying and unknown exposures are to be developed, the following method and formulas may be employed with confidence. They were given by A. J. Jarman in *The Camera*, a few years ago, as used by him in a considerable experience in the photographic department of the *Scientific American*. As an instance of the practical success of the method, Mr. Jarman states that he used it in the development of a batch of 500 6½ x 8½ plates of exterior and interior subjects, all the exposures having been made by several different operators working 2,000 miles away from New York, and none of the exposures being known, with a loss of two plates only, due to excessive underexposure.

Simple; Economical; Practical

The method may, at first, seem somewhat complicated; but is not so in practice, and the results are well worth the trouble of preparation involved. By the use of a freshly made acid fixing-bath of good strength, preferably stored in a stoutly built, grooved wooden tank, any stains or coloration in the negatives due to the repeated use of the pyro developer advised may be completely eliminated. The method is as economical as it is practical.

Stock Solutions

First, make up the following stock solutions in wide-mouthed bottles and label them: *A*—Pyro; *B*—Sulphite; *C*—Carbonate; *D*—Bromide of Potassium, 10 per cent solution.

A. Pyrogallic acid, 1 oz.; filtered water, 8 ozs.; citric acid, 20 grs.; sulphite of soda (dessicated or dry), ½ oz. Add the citric acid to the water first, then the sulphite, lastly the pyro.

B. Sulphite of soda (dessicated or dry), 1½ ozs.; filtered water, 16 ozs.

C. Carbonate of soda (dessicated or dry), 2 ozs.; filtered water, 16 ozs.

D. Bromide of potassium, 1 oz.; filtered water, 10 ozs.

Employ a 6½ x 8½ tray to develop in, and an 8 x 10 tray to cover the 6½ x 8½ tray with, so as to screen the plate during development from the unnecessary action of ruby light, uncovering the developing-tray only just time enough to observe the progress of development. The glass graduates required will be as follows: One 2-ounce, one 4-ounce, three 8-ounce, making five in all. Make a clear space directly in front upon a clean shelf for the bottles and graduates.

Developing Solutions

Take the 2-ounce graduate, measure out 6 drams of pyro—*A*—pour this into one of the 8-ounce graduates. Add to this 12 drams of—*B*—sulphite solution and 1 ounce of —*C*—carbonate solution and 8 ounces of water.

Now mix up the following in the second 8-ounce graduate: *A*—pyro, 1 oz.; *B*—sulphite, 2 ozs.; *C*—carbonate, ½ oz.; add to this 3 drams of the *D*—bromide solution and 8 ozs. of water. Pour into the third 8-ounce graduate—2 ounces of the strong developer and 2 ounces of the contrast developer, the last made. Add in addition 3 or 4 drops of the bromide solution, fill the 4-ounce graduate with the contrast developer. Stand all in a row ready for use.

Working the Method

Only one plate should be taken in hand at a time, because of the unknown time of exposure, and the uncertainty of its being an interior or exterior.

Take a 6½ x 8½ plate, place it in the 6½ x 8½ developing-tray; now wet it all over with clean, cold water, rock the tray so as to completely wet the surface all over; this will prevent air-bubbles being formed. If there should be any bubbles, rub the two forefingers on the right hand over the surface of the plate (no harm will accrue from this treatment). Pour off the water, and quickly in one sweep pour the mixed developer upon the plate. Cover it at once with the 8 x 10 tray, rock the plate to and fro, then crosswise, then in the course of about half a minute, lift the 8 x 10 tray, and watch the development. If it appears to come up gradually, allow development to proceed until correct density is obtained; if the development is proceeding rapidly, pour off the developer into the graduate, wash the plate under the faucet quickly, and pour on the developer from the 4-ounce graduate. This will at once check development and allow the highlights to gain in density, keeping the shadows clean and clear until development is complete. As soon as development is complete, pour the developer back into the 4-ounce graduate, rinse the plate under the faucet and insert it into the fixing-bath. Allow it to stand there in the groove until the remainder of the plates are developed and the fixing-box is filled.

Take another plate, treat it with water like the previous one, pour on the mixed developer from the 8-ounce graduate, cover it, rock the tray as before, then examine the development. If the picture does not come up within 1½ to 2 minutes then the plate is undertimed. Pour off the developer into the graduate, rinse under the faucet, and pour on about 3 ounces of the strong developer, cover again, rock the tray and in the course of a few seconds examine the plate. It will be found that the whole image is developing rapidly and well. Allow this to proceed until development is complete, then rinse the plate and place in the fixing-bath with the others. The developer must be returned to the graduate for future use. It will be found that seven 6½ x 8½ plates can be developed perfectly by this method, when the solution must be thrown away and fresh developer made up for use as before.

It will be found by this plan of developing that every plate can be made to yield a good negative, no matter whether the time of exposure is short or overtimed. By this plan there are three distinct developers, each having separate properties so as to permit of correct development for various times of exposure; unless the plate has been hopelessly under or overexposed there will be no chance of losing a plate. For practical everyday working this plan of development gives the much-desired control, which so many photographers, both amateur and professional, wish to know, and saves many a plate which would otherwise be completely spoiled.

An Alternative M-Q Formula

A method similar to the above, but employing a mixture of metol (or any of its equivalent substitutes) and hydroquinone, and therefore perhaps preferable for amateur use, is given as follows: Three wide-mouthed 12-ounce bottles will be needed, since the method calls for the use of three developing solutions, which are made from two standard solutions.

Stock Solution

First, prepare a stock solution: Hot water, 20 fl. ozs.; metol (satrapol or other metol equivalent), 100 grs.; hydroquinone, 30 grs.; sodium sulphite (dry), ½ oz. (Troy); sodium carbonate (dry), ¾ oz. (Troy); potassium bromide, 12 grs.

As soon as the above salts are completely dissolved, take 10 ounces by fluid measure, place this in the first 12-ounce bottle and label it No. 1. Pour 10 ounces of the stock solution into the second 12-ounce bottle, and add 12 grains more of bromide of potassium. Mark this bottle developer No. 2. The third bottle must stand in readiness to receive the mixed developers after they have been used upon the plate in the following manner:

Method of Use

Take of developer No. 1, say for a 5 x 7 plate, 2 fluid ounces, and of No. 2 developer the same quantity. Mix them, place the plate in a tray, preferably a black hard rubber tray, pour the mixed developers upon it. Then after a short time examine the plate. If the image is coming up well, with no veiling, and the whites, as they are termed, remain, with no tendency to fog, then continue the development. Only take precaution to cover the tray containing the plate with another tray, say a 6½ x 8½, during the time of development, uncovering it only to examine the progress of development. If the development is going along all right let it continue until the right density is attained, when the plate may be washed and fixed. But if the development proceeds slowly, by the use of the mixed developers, and the image does not come up at a moderate speed, then pour it into the third bottle. Wash the plate and tray, and pour on the No. 1 developer. This will be found to bring the image up rapidly. Then when development is complete return the developer to the No. 1 bottle for future use. Should the image flash up rapidly in the mixed developer, return the solution to the third bottle, wash the plate with a quick supply of water and pour on the No. 2 developer, the one containing the double quantity of potassium bromide. This will, in nine times out of ten, save the exposure and yield a good negative.

All these solutions may be used many times over, taking care to return each developer to its particular bottle. It will be found with a very little practice that this plan of development will save many negatives that would otherwise be lost.

In practice it is about the nearest way to developing a plate according to the time-exposure that it is possible to get, and, coupled with the fact that these developers may be used over and over again, almost until the developing power is exhausted, it will be found to be not only effective but economical also, and suited to the needs of the amateur photographer.

Pyro for Underexposure or Night Pictures

In the development of a special class of subjects, such as night photographs, or flowers and trees photographed in dull, diffused light out-of-doors, or flashlight portraits, wherein it is essential that the shadow details in the negative shall be brought out very soon after the appearance of the highlights, to secure harmonious negatives without excessive contrasts, the following method and formula, due to Montague Wickham, will give the desired results.

Stock Solutions

Prepare the following stock solutions: No. 1—Pyro, ¼ oz.; potassium bromide, 10 grs.; metabisulphite of soda, 15 grs.; water, 20 ozs. No. 2—Sodium sulphite, 2 ozs.; sodium carbonate, 2¼ ozs.; water, 20 ozs.

This solution, it will be noticed, includes bromide of potassium, ¼ grain to the ounce of mixed normal developer. Although it may be that bromide of potassium should be omitted, I am inclined to think that the proportionate quantity included allows the development to be prolonged, thereby allowing more detail to be brought out in the shadow portions of the negative. The omission of the bromide of potassium may also occasion the possibility of fog.

Working Method

The method I usually adopt is to take of the stock solution 1 part of No. 1 and add 2 or more parts of the No. 2 solution, at the same time considerably diluting the solution with water. As regards the excess of the No. 2 solution (as compared with the usual normal proportions), it must be regulated according to the class of subject upon which the plate has been exposed, and this can only be gauged by practical experience, although I might say that where there is considerable contrast—as, for instance, in a street scene lit by one or two lamps—it would be necessary to use a greater quantity of the No. 2 solution in proportion. Where the subject photographed is evenly illuminated, the quantity of the No. 2 solution need not be so great.

For an average exposure of any of the classes of subjects mentioned, make up a solution in the following proportions: No. 1 solution, 1 part; No. 2 solution, 2 parts; water, 12 parts.

These proportions can be recommended as the basis of development. In a normal temperature the highlights would begin to appear in about 1½ minutes, and development must be continued until sufficient density has been obtained in the shadow portions of the negative, and the judgment of this is a matter requiring considerable attention. With pyro-soda it may happen that no detail can be seen in the darkroom, but when the negative is dry the detail is clearly discernible.

When it is necessary to prolong the duration of development, it will be desirable to make up a fresh solution in the same proportions (or varied to suit the progress of the development) and throw away the developer which has become stained, or is likely to affect the proper working of the solution. By so doing it will be possible to keep the negative clear and free from foreign matter. The negative should be covered up to shield it from the light, except where it is necessary to examine the progress of development.

It is really surprising how a negative developed in this way (provided it has not been overexposed) will be kept clear of fog. Again, it is remarkable to what degree the excess of the No. 2 solution can be carried without ruining the resulting negative.

Importance of Temperature

An important factor which has been suggested in the development of a night negative is the question of temperature. More detail is apparently brought out in the shadow portions of the negative when the temperature of solutions, etc., is raised to 72° F., and it is often advisable to develop a night negative in as warm a solution as possible. There is no doubt that by these means some advantage is obtained, but it is probable that the use of the excess quantity of the No. 2 solution will give as good results at normal temperature—i.e., 65° F.—as those obtained by increasing the temperature of the solutions.

Should the negative be lacking the desired detail in the shadows when development has continued for some time, it may be immersed in a strong solution of pyro-soda—i.e., No. 1, 1 part; No. 2, 1 part; water, 2 parts.—for, say, up to 30 seconds; but this manipulation must be carefully watched, in order to avoid the highlights becoming too opaque or halated.

In the development of a night negative the object must be to obtain that necessary small amount of detail in the shadows, even at the risk of overdoing the highlights, which is essential to give interest to the subject.

Development at High Temperatures

The possibilities of development at high temperatures, ranging from 80° to 100° Fahr. or higher, are exceedingly interesting, whether viewed as a means of compensating for known, extreme under-exposure (as in press, military, or commercial photography), as offering a "way out" in tropical development where refrigeration is impracticable, or as seen by the man in charge of a "while you wait" studio.

Crabtree's Investigations

The literature of the subject is meager and abounds in conflicting statements which afford little actual information to the practical worker. Quite recently, however, Mr. J. H. Crabtree, of the Eastman Research Laboratory, has published (in Bulletin No. 62) the results of an extended investigation of these possibilities, especially in the development of Kodak rollfilm at temperatures around 95° Fahr. His paper, unfortunately, is too lengthy for inclusion here, but should be seen by all interested in the subject, as offering much valuable and practical information. It was republished in full in "The British Journal of Photography" of November 2, 1917, and the issue of that journal for the following week, November 9, 1917, contains an editorial commenting on the paper from the viewpoint of its usefulness in everyday professional photography. Both issues can, I believe, be obtained from the publishers of the "B.J.," 24 Wellington Street, Strand, London, W. C. 2, England, in return for International Postal Coupons of the value of 20 cents (10d), which can be had at any postoffice. Here I give only the Summary provided by Mr. Crabtree at the end of his paper:

Summary

"Rollfilms, filmpacks and plates, whether new or date-expired, may be successfully developed under tropical conditions (up to 95° Fahr.) by means of most developers, with the addition of 10 per cent sodium sulphate and some potassium bromide to prevent fog, but much better with a special developer compounded with paramidophenol-hydrochloride. Although it has been recommended to develop films in the tropics by hardening the same either before or after development by the addition of a hardener such as formaline, it is only possible to secure the best results by using a developer free from such additional agents. The formula for the developer is as follows: Paramidophenol-hydrochloride, 60 grains; sodium sulphite (E.K.Co.), 440 grains; sodium carbonate (E.K.Co.), 440 grains; water to 20 ounces.

"After development rinse only for a second or two before placing in the fixing bath, otherwise the film is apt to soften in the rinse water.

"The time of development with Eastman N.C. film at 95° Fahr. for normal contrast is 1½ minutes, though the time of development may be doubled by the addition of 880 grains of sodium sulphate to the above quantity of developer.

"At temperatures up to 75° Fahr. the regular acid fixing bath should be used, but at temperatures up to 85° Fahr. the following chrome alum bath is necessary: Hypo, 7 ounces; sodium sulphite (E.K.Co.), 1 ounce, 175 grains; potassium chrome alum, 2 ounces, 350 grains; acetic acid (glacial), 40 minims; water to 32 ounces. This is made up by avoirdupois weight. Dissolve the sulphite and chrome alum together and add to the hypo solution, finally adding the acetic acid.

"At temperatures up to 95° Fahr. the following formaline bath should be employed: Hypo, 9 ounces; sodium sulphite (E.K.Co.), 1 ounce, 350 grains; formaline (formaldehyde 40 p.c.), 4¼ ounces; water to 32 ounces. Avoirdupois weight. First dissolve the hypo, then the sulphite, and finally add the formaline.

"In order to eliminate the odor of the formaline, the bath should be inclosed in a covered tray as far as possible. The above baths keep well at the temperatures stated, so that for the professional and amateur finishing trade the special chrome alum bath is very suitable, while for expeditionary work, where very high temperatures may prevail, the formaline bath will give perfect results."

Developing Power and Exhaustion

The comparatively early exhaustion or "falling off" in developing power exhibited by some of the "new" developers when used repeatedly, has brought forward questions as to how far this exhaustion is due to air oxidation, and just how many plates could be developed with any given developer before its power became totally exhausted. Practically all the information readily available on these points is contained in a statement in Watkins' "Manual," that an added time of 20 per cent must be allowed for each successive plate developed by the time and temperature method in a given quantity of developer.

A Series of Tests

As the result of an extended series of tests made with scrupulous care by the Hess-Ives Co., with pyro, Rytol, Monomet-hydroquinone, Agfa metol-hydroquinone and Hitol, in which 200 plates which had received uniformly identical exposures on an outdoor subject and standard developer formulas at a uniform temperature were used, the following interesting facts were determined.

Oxidation

1. That less than 5 per cent of the falling away in efficiency of a developer is due to air oxidation—pyro alone excepted. The test negatives were developed in a tray by the factorial method, one following another through the developer in rapid succession. The tray was rocked continuously during development, and no effort was made to protect the plates from the air.

Capacity of Different Developers

2. As to the developing capacity of the different developers tested, named above, it was found that: (*a*) With the Watkins Standard 2-grain Pyro formula, seven plates could be developed before the exhaustion point of the developer was reached, the time of development ranging from 5 to 22 minutes. The eighth plate refused to develop at all, although permitted to

remain in the developer 6 hours. The fourth, fifth and sixth plates showed an increasing amount of "pyro stain." (*b*) With Rytol (1 to 4) the eighth plate required just over 20 minutes to develop, and the tests were discontinued at this point as having exceeded usable limits. (*c*) With Monomet-hydroquinone the eighth plate was developed within 10 minutes, so the tests were continued until it was seen that the fifteenth plate required 80½ minutes to develop, when this was discarded as having exceeded usable limits. (*d*) With Agfa metol and hydroquinone (Watkins Standard M-Q formula) the fifteenth plate required 26½ minutes to develop, after which the developer was discarded. (*e*) With Hitol (standard dilution 1 to 12) nineteen plates were developed before the exhaustion point was reached, the time of development required for the nineteenth plate being slightly over 17 minutes.

A Correction

In sending for my examination, the data and plotted curves from which the above conclusions have been taken, the Hess-Ives Co. takes exception to the statement regarding paramidophenol-hydrochloride on page 435 of THE PHOTO-MINIATURE No. 167, beginning "It is not so in fact," and ending, "in developing power and efficiency." According to exhaustion tests made with this developer by the Hess-Ives Co., a normal paramidophenol developer was exhausted after the development of sixteen exposed plates, the time of development required for that plate being almost 35 minutes. To the 6 ounces of developer used (and apparently exhausted), 40 minims of a 10 per cent solution of caustic soda were then added, and a seventeenth plate developed in 7½ minutes. Forty minims of the 10 per cent caustic soda were again added, and the eighteenth plate developed in 5½ minutes. This showed a remarkable "come-back" so far as time of development was concerned, but both the seventeenth and eighteenth plates were too "contrasty" to have any printing value.

Instantaneous Development

The following radical innovation in development methods deserves the careful attention of those who have to develop and finish large batches of exposed films or plates in a very short time, or amateurs who rebel at the tedium of development by the methods in everyday use. It is especially useful to commercial or trade finishers, darkroom workers in plants where photography is used for producing industrial records in quantities, and in military or aërial observation work, where speed is important in reaching the print.

The method is due to F. J. Mortimer, editor of the London *Amateur Photographer*, the technical excellence of whose work is well known. I have given the method many tests with American plates and films with complete success, and have no hesitation in endorsing it as at once practical and time-saving.

Substitute Developers

Since metol (German) and rodinal are no longer obtainable, I have employed satrapol, Gennert's monomethylparamidophenol-sulphate, Metol-Johnsons and monomet in place of the former, and azol and citol in place of rodinal, without noticeable variation in results, hence these may be substituted in the formulas given.

Avoiding Trouble

It will be noted that the method calls for concentrated solutions and the use of caustic alkalies. To avoid any skin troubles or poisoning likely to arise from these, I have adopted the following precautions in my use of the method: (1) Before development, thoroughly massage the fingers and hands with a good cold cream; (2) wear stout rubber gloves while working; and (3) after development thoroughly cleanse the hands with soap and warm water, after which rub in more cold cream and dry thoroughly. With these precautions I give the method as originally published by Mr. Mortimer.

The Argument

The statement that a spool of sensitive film or a dry plate exposed in the camera in the ordinary way can be fully developed in less than a quarter of a minute may possibly arouse a certain amount of disbelief. The further statement that such a period as a quarter of a minute will, under certain conditions, produce overdevelopment, and that perfect negatives equal to those secured by any other form of chemical action can be produced in *less than 5 seconds,* calls for explanation.

It is with a certain amount of trepidation that one comes into conflict with well-established theories. In photographic procedure the comparatively prolonged action of dilute developers in the production of well-gradated negatives is generally accepted as correct. It may be well, therefore, to say at the outset that, while such procedure appears to be sound in both theory and practice, the method described hereafter is, so far as the author is concerned, sound in practice only. Pressure of other work has not permitted sufficient time for the investigation of the theory. It is, however, by their practical application that most theories stand or fall. When, therefore, it is said that with this form of development—during the last six months—at first experimentally, and then with increasing wonder, and lately with full confidence, most of my own negatives have been produced, the reasonableness of the request for a hearing will not be denied.

Principles

To return, however, to the original statement. The ratios of time of first appearance of the developable image, time of complete development, and the temperature are now fairly well understood by most photographers, thanks to the preachments of Mr. Alfred Watkins. A fourth factor—the dilution of the developer—has not been taken into account to any extent, because it has been understood not greatly to affect the other ratios. So, for instance, if a certain developer with a factor of ten gives its first appearance of image in 20 seconds at a temperature of 65° F., it will produce its fully developed negative in 200 seconds, or 3⅓ minutes. If the solution is diluted with an equal bulk of water, at the same temperature, it will normally give its first appearance of image in 40 seconds, and complete development will be effected in 400 seconds, or 6⅔ minutes, and so on.

It has not been generally realized that the converse is equally capable of practical application. If instead of diluting the developer by halving its strength it is concentrated so that it is made double as strong, the other factors still hold good. With the developer mentioned above, the image would appear in 10 seconds, and development be complete in 100 seconds. Double the strength again, and the completed negative will be finished in 50 seconds.

Theory vs. Practice

Here, however, the theorist will probably step in. The *reductio ad absurdum* has been anticipated. He says: "According to this principle, if the developer is sufficiently concentrated it would be possible to make the appearance of the image in 1-100th of a second and complete development in 1-10th second."

"Granted," says our friend; "and assuming that it is possible to completely and fully develop the image in even 5 seconds, according to the original statement, how about the quality of the negative?" That is for each to judge. Suffice it to say that, out of many hundreds of negatives on both films and plates developed by this method during the past few months, experimentally and otherwise, there is absolutely nothing in the way of gradation rendering, strength of high lights, clearness of shadows, cleanness of image, and freedom from graininess and physical defects generally that would distinguish the results from technically good negatives successfully produced by any other means. The points demanding attention, therefore, are concentration of developer and dexterity in manipulation.

Concentration of Developer

It is well known that if a formula for an ordinary developing solution is taken (and there are many hundreds of them) and the quantity of solvent, *e. g.*, water, is reduced to, say, one-quarter, the chemicals will generally refuse to entirely dissolve, and some will remain in solid form in the liquid. If it is boiled they may dissolve, but on the solution cooling are again precipitated as solids. The use of caustic alkali, *e. g.*, sodium hydrate or potassium hydrate, instead of the carbonate will, however, in many cases enable a much greater degree of concentration to be arrived at. Either of the following formulas are typical examples of highly concentrated developers:

Formulas: Concentrated M-Q

Hot water, 10 ozs.; sodium sulphite (cryst.), 4 ozs.; metol (or any of the substitutes mentioned), 100 grs.; hydroquinone, 200 grs.; sodium hydrate, 200 grs. Be careful to get complete solution, adding, if needed, more caustic alkali to facilitate this.

Paramidophenol-hydrochloride Hot water, 10 ozs.; sodium sulphite (cryst.), 3 ozs.; paramidophenol-hydrochloride (Kodelon or any other reliable brand), 1 oz.; sodium hydrate, q.s.

Add the caustic soda in strong solution until there is complete dissolving of the precipitate first formed.

Instead of these the commercial concentrated developers—Rodinal, Azol, Citol or Paranol—can be used.

Manipulation Although it may appear a small matter to record, a certain amount of faith is necessary to follow the advice: Pour a bottleful of "neat" Rodinal onto a cherished exposure and so obtain a perfect negative instantaneously. Yet this, in brief, is the method advocated; and the only corollary to be added is: Do not waste time in getting the negative out of the developer into the fixing-bath. Either of the formulas given above or the commercial solutions mentioned give a sufficiently concentrated solution to produce a perfectly developed negative from a properly exposed plate or film, and, moreover, a beautifully clean negative, in less than 5 seconds.

Five seconds have been given as the average time in which the developer can be made to completely cover the plate, or in which a short length of film (Ensignette six-exposure, V. P. K. eight-exposure, 2½ by 3½ and quarter-plate six-exposure, larger sizes double-twos) can be drawn once deliberately through the solution and back again. The avoidance of markings is purely a matter of practice and taking care to rinse the film or plate first in plain water.

Feel Your Way As a beginning, do not use the fully concentrated solution. Be content to develop the exposure in, say, half a minute. Dilute the developer 1 part in 6 of water. First, if a spool film is being treated, run it through a dish of plain water, see-saw fashion, for a minute until it is thoroughly wetted. Pass the fingers over the surface to remove any small air-bells. Have the developer in a deep dish, which need not be much wider than the width of the film—this for economy of the developer. Hold the end of the film between the finger and thumb of the right hand. Let the film hang straight down, and take the other end between the fingers and thumb of the left hand. Plunge the lower end into the solution and gradually draw it through and up, at the same time lowering the right hand holding the other end. Continue the action, drawing the film through the developer in a U-shaped loop, until the fingers of the right hand holding the other end of the film are in the solution and the left hand is uppermost, holding the film straight down again. This is, of course, the usual method of dealing with films which are not developed in a tank. In this case, however, the tiring monotony of see-sawing the film up and down for, say, 10 minutes in a normal developer is avoided. By using the formula as given (1 in 6) the negatives will be fully developed in half a minute. Reduce the dilution to 1 in 3, and 15 seconds will suffice to complete development.

After Skill Comes

When sufficient dexterity is gained, the film can be completely submerged, passed regularly through the strong solution and back again, while slowly counting one—two—three—four. The image literally flashes out as the surface of the film comes into contact with the solution, and within the time mentioned is developed through to the back. A slight pause is, perhaps, advisable as the right-hand end comes to the developer, to compensate for the double passage through the liquid of the rest of the film; otherwise, a steady, unwavering action is best. The film can then be passed straight into a strong acid fixing-bath: Hypo, 6 ozs.; metabisulphite of potash, ½oz.; water 20 ozs. When fixed, the film is thoroughly washed and dried as usual.

Large Films or Several Plates

It will be clear that for the worker with larger and longer spools of film or where several plates are developed together the concentrated solution will have to be diluted somewhat to allow time for the actual passage of the film through the developer. The amount of dilution is, however, regulated entirely by the dexterity of the worker. If he can pass, say, a ten-exposure postcard spool into the developer (being more diluted, a larger quantity and a bigger dish can be used), unroll it under the solution from one side of the dish to the other and back again twice in 1 minute, the developer can be used diluted with about ten times its bulk of water.

It should be borne in mind, however, that temperature plays an important part in this matter of speedy development. In the case of the metol-hydroquinone formula, this is specially worthy of note, as the well-known effect of low temperature on hydroquinone developer is very marked in the concentrated solution. Therefore, use all developers, especially during the winter months, at not less than 65° F. The action slows perceptibly as the temperature falls below this, a fact that may be taken advantage of to prolong the action in place of dilution, but it is doubtful whether the resulting image is as good and full of gradation as when the temperature is higher.

Advantages and Disadvantages

It may be asked at this juncture, What are the advantages of the process? Apart from the actual fact that a most remarkable saving of time is effected in development, with no falling off in quality, one has only to experience the task of dealing with a great number of small films to appreciate its value.

For the worker who has stood for many weary hours developing films until his arms ache, and who cannot afford a series of developing tanks, the method should be hailed with delight. The only disadvantage that is likely to be set off against the advantages is the question of cost. The developer being used in an undiluted form is likely to be more wasteful, but if care is taken and the developing dish is stood inside a larger one, so that all overflow can be poured back again, it is surprising how long 2 or 3 ounces of developer will last. It appears to keep better in its concentrated form, and can be used over and over again until it loses its potency.

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Men not registered for the draft, and who possess the necessary qualifications, should write to the Air Division, Personnel Department, 136 K Street, N. E., Washington, D. C., for information as to enlistment, accompanying their letter with evidence of their qualifications.

Men registered for the draft in the states of New York, Pennsylvania, Ohio, Michigan, Indiana, Illinois, Missouri, Massachusetts, New Jersey, Rhode Island, and Maryland, who desire to be voluntarily indicted for this service, should apply to their Local Board and submit evidence of their qualifications. At present these are the only states to which this call applies.

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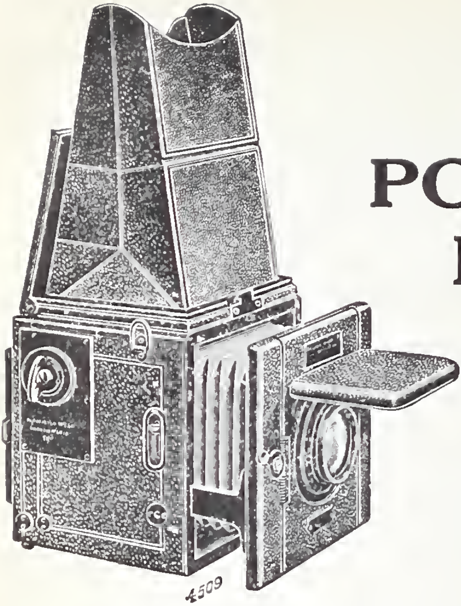

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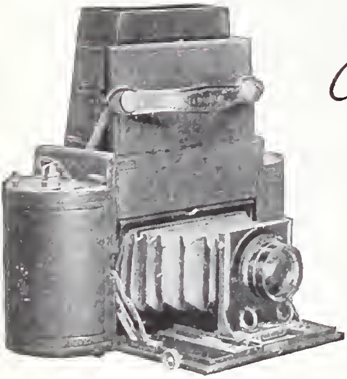

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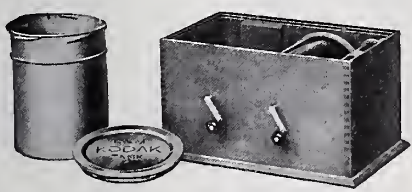

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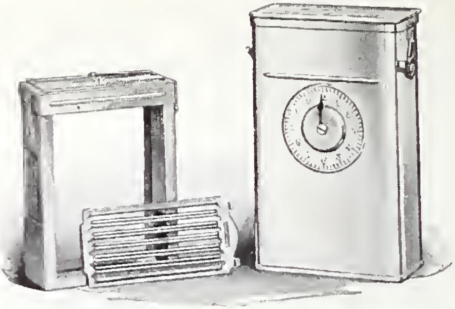

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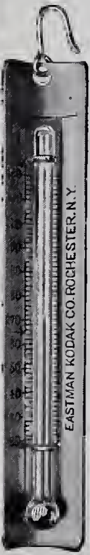

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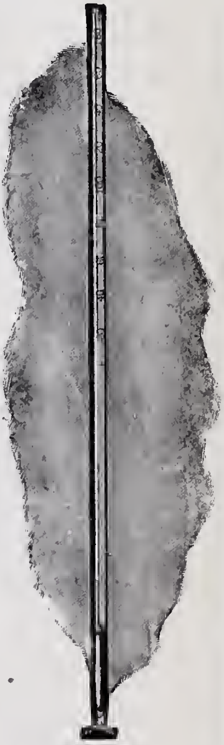

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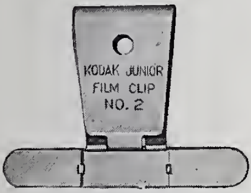

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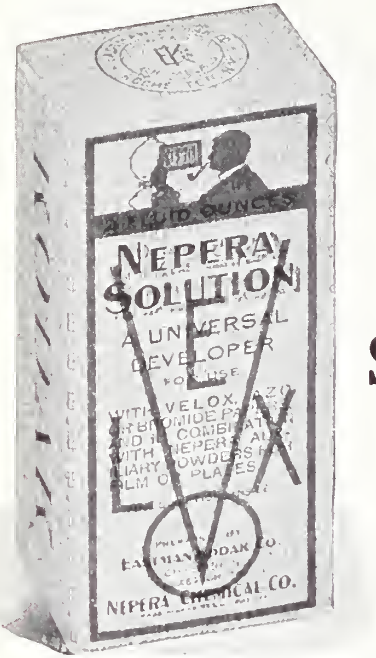

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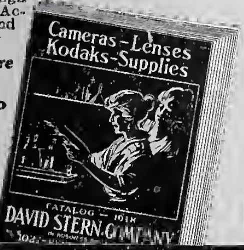

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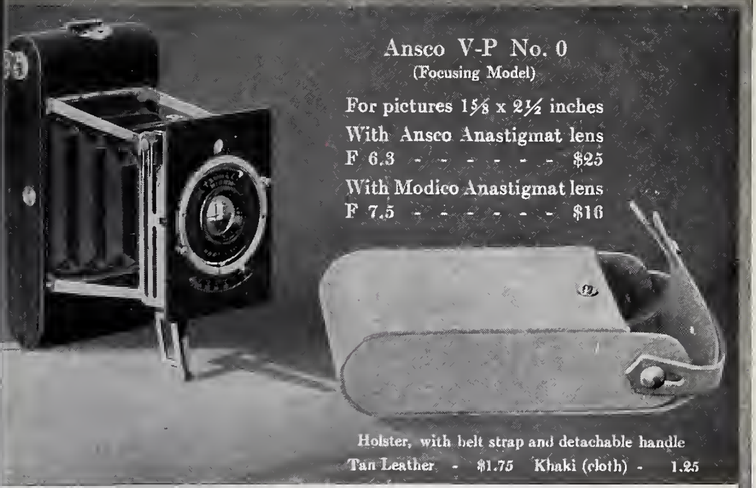

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